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Introduction: Special Issue on the 40th Anniversary of the *Alberta Journal of Educational Research*

The arrival of one's 40th birthday is usually cause for reflection and rumination. In this society, it is considered an important watershed or a midpoint in the life span. Although the anniversary of an inanimate object (such as a journal) cannot reflect upon itself, a 40th anniversary is a convenient point for others to reflect upon what the *Alberta Journal of Educational Research* (AJER) has contributed up to this point. Writing a summary of what has transpired, we feel, would likely alter the Zeitgeist of the AJER under its various editors. Thus, to present a clearer view of the journal over the past 40 years, we decided to seek out as many former editors as possible and invite them to select what they believe to be an outstanding article published in AJER during their tenure as editor. Former editors were also encouraged to provide a brief introduction to the article selected and/or comment on developments in educational research. Each article selected for this commemorative issue of AJER is reprinted in its original form (although the page numbers have been changed); editors' introductions and comments accompany the reprinted articles.

Although all the editors of the AJER in the past 40 years have been from the University of Alberta's Faculty of Education, there has been great diversity in their backgrounds and in their interests. It is for this reason that the AJER has not obtained a reputation for being the vehicle for a particular discipline or of one particular point of view. The first editor was Dr. Harold Baker, Head of the Division of Secondary Education; his successor was the second Dean of the Faculty of Education, Herbert E. Smith, who had worked with education programs at the University of Alberta since 1929. Subsequent editors include another former dean, several former department chairs, and outstanding professors who did not select administrative positions.

When we set out to invite past editors to select an article for this issue, one problem that faced us was that the first three editors (Harold Baker, Herbert Smith, and G. Eastwood) are deceased. Their tenures represent the first 12 years of the AJER. Given that the first years of the AJER are as important as subsequent years, and given our commitment to minimizing modern interpretation of the past, we decided that what was required to take the place of the first three editors was an individual who was in the Faculty of Education during the mid 1950s, who was acquainted both with educational research and those individuals associated with it, and who remains closely associated with

educational research today. These requirements were met admirably by Dr. Stephen (Steve) Hunka, University Professor of the Department of Educational Psychology.

Apart from the first 12 years of publication, most subsequent years of the *AJER* are represented by the original editors. Overall, the articles selected for this issue reflect the eclectic flavor of the journal. The studies presented here include quantitative and qualitative methodologies, historical analysis, evaluation research, and integrative reviews. This special issue concludes with research abstracts from the 1993 and 1994 winners of the G.M. Dunlop awards for outstanding master's and doctoral theses.

Steve Hunka

Alberta Journal of Educational Research: 1955-1965

During the first decade the *AJER* published slightly over 270 articles. A trend in the nature of these articles can be identified over the 10-year period. To understand the nature of this trend requires placing the articles in the context of the developing nature of educational research, the academic program at the University of Alberta, the state of public education in Alberta including the demography of the teacher and student population, and the goals and aspirations of those who brought the *AJER* into existence.

It appears that one goal held by the promoters of the *AJER* was to provide an educational research capability and facilities that could shed light on current educational problems in Alberta, and that would be of interest to a variety of stakeholders including the academic staff in the Faculty of Education, the teachers and administrators in the field, and supporting organizations such as the provincial government, Alberta School Trustees' Association, the Alberta Teachers' Association, the Home and School Association, and individual school boards. Then, unlike today, these organizations had little capability to carry out educational research on their own. Through the aegis of the Alberta Advisory Committee on Educational Research, an unprecedented level of cooperation between the field and the Faculty of Education to promote and carry out educational research was established that remains unrivaled to this day. Significant problems were researched, at least as perceived by academic staff members particularly in educational psychology and administration, some of whom had recently joined the University of Alberta after completing their doctoral programs. Problems that were considered significant included individual differences and disparities in educational achievement in Alberta schools, teacher education including retention and recruitment, high school dropouts, promotion policies in elementary schools, and administrative leadership. During the latter period of the decade problems of a more academic nature began to appear, partly due to interests of new staff members, and partly because the *AJER* published the results of graduate student research carried out largely by individual researchers.

Selecting one article that is in some sense outstanding during the first decade of *AJER* presents difficulty without defining what *outstanding* might be, because many different criteria could be used. For example, one might select an article because of its longstanding contribution to knowledge about education, its academic and technical merit, or its contribution to the solution of a problem current on the date of publication. A complicating factor in the selection is that the styles of educational research have changed as well as the availability of knowledge provided by other disciplines from which educational research borrows many of its procedures and techniques. In addition, facilities available for conducting educational research have changed dramatically with the introduction of the computer.

The article selected in commemoration of the first decade of *AJER*, entitled "A Study of the Written Composition of a Representative Sample of Alberta Grade Four and Grade Seven Pupils" by Coutts and Baker, is characteristic of many similar articles that provided information about the individual differences of students in Alberta schools. These articles in different subject matter areas are characterized by the use of large sample sizes and statistical comparisons in achievement among students in urban, town, graded rural, and ungraded rural schools. These articles, of course, also relate indirectly to the problems of teacher education and demographic characteristics of the population in Alberta, as well as to the instructional problems that come with classes in which students show a large degree of variability in abilities and competencies.

A STUDY OF THE WRITTEN COMPOSITION OF A REPRESENTATIVE SAMPLE OF ALBERTA GRADE FOUR AND GRADE SEVEN PUPILS

H. T. COUTTS AND H. S. BAKER

Faculty of Education, University of Alberta

Background and Purpose of the Study

The present study is supplementary to a large survey of the reading and language achievement of grade IV and grade VII students in Alberta.¹ For this survey, a representative sample of students was chosen in such a way that all geographic areas, types of school organization, socio-economic and ethnic groups would be included. The city sample was drawn from Edmonton and Lethbridge, the town sample from eight towns (school population 250-1,000) randomly chosen. The graded rural sample included only rural pupils attending graded schools, the ungraded sample only rural pupils attending one-room rural schools. Slightly less than 1,000 pupils were included in each of the grade IV and grade VII samples.

The general purpose of the present study was to examine, evaluate and analyze the written composition of Alberta boys and girls at the grade IV and grade VII levels. More specific purposes were:

1. The compare achievement at these levels—both as to the quality and expression of ideas, and the correctness of mechanics and usage—among the various subsamples.
2. To explore correlations between each pair of the following variables for which data were available: intelligence, rating of the quality of ideas of an original composition, rating of correctness in mechanics and usage, and the total score on the California Language Test.

Design and Procedure

Assignment

The writers believed that, if the results were to be valid, all students at each level should be asked to write on a common topic of sufficient breadth that pupils of varied backgrounds could react to it. They further believed that it should be planned to stimulate boys and girls to marshal ideas from their own experience, to organize these ideas thoughtfully, and to write a short composition in as clear and effective a manner as possible. Actual assignments were as follows:

¹For further information concerning this survey, see "A survey of Reading Achievement in Alberta schools" in the March 1955 issue of this Journal. See also, in the present issue, the editorial page and "A Survey of the Language Achievement of Alberta School Children," pp. 39-52.

GRADE IV

Joe can hardly wait to get home after school. He's building a model airplane, and in a couple of days he'll have it ready to fly. Bill heads for the playground, where he finds several friends eager to play ball with him. Sue goes straight home to read, while Mary and Ellen get out on their roller skates as fast as they can.

What do you like to do after four o'clock, when school is over for the day? Tell about it in one or more paragraphs. Use the title *Fun After Four*. Things you might mention are why you like it, how you do it, and any other interesting facts about it.

Arrange your ideas and sentences as smoothly as you can, planning and trying them out on page 2, for *rough work*. Then rewrite them on page 3, for *finished work*. You needn't fill all the lines, although you should tell enough to be interesting.

Use pencil for all your work.

GRADE VII

Everyone has a hobby. Some boys and girls raise stock or grain for show. Some boys prefer building models, radio sets, or machines. Girls often like to embroider, to sew, or to do leather work. Some boys and girls collect things: stamps, coins, pictures, recordings. Others prefer to paint, to play the piano. No matter what your hobby is, you must have very good reasons for liking it. Write a composition of 150-200 words under the title *Why My Hobby is Important*. You may arrange your composition in one or more paragraphs depending upon how you want to organize your ideas.

Suggested Procedure

1. Write down the ideas you want to include.
2. Make a brief outline or plan of your composition.
3. Write your composition in rough form in the space provided.
4. Check your composition, making additions and alterations for improvement and correcting spelling, grammar, punctuation, and sentence form if necessary.
5. Copy your composition carefully in ink beneath the words *FOR FINISHED WORK*.

Evaluation and Scoring

Quality. The writers were aware of the existence of the *Hudelson English Composition Scale* and of other such scales. None seemed suitable for use in Alberta under the conditions of the present study. It was therefore decided to develop a scale specifically for the assignments made to Alberta grade IV and grade VII students, and based on the compositions written through the stimulus of the assignments.

Scoring instruction were as follows:

Evaluate the papers on a five-point scale using the following criteria for guidance. Enter the value in the space provided on the record card under the heading *Ideas, Organization, Presentation*.

Value 5: The qualities suggested for 4 plus such added qualities as the happy turn of phrase, added polish, greater maturity of thought.

Value 4: Selection of Ideas.

Unity of Ideas—stays with the topic.

Paragraphing—paragraphs used when necessary.

Use of Connectives—connectives used when necessary.

Sentence organization—sentences logically organized.

Sentence Variety—reasonable variety in sentence structure to give a pleasing effect.

Style—pleasing and unpretentious style.

Appearance—agreeable as to appearance.

Value 3: The same qualities as in 4 above, but only average in effectiveness. Will include papers otherwise well written but not on the topic assigned.

Value 2: Lacking in most of the qualities as in 4 above, but intelligible.

Value 1: Generally lacking in the qualities of 4 above. Is incoherent, garbled, illogical, immature, obscure.

For papers graded 4 and 5 check under "Reasons for Evaluation" the specific points of strength which led to the evaluation placed on the paper.

For papers graded 1 and 2 check under "Reasons for Evaluation" those items in which the paper was so deficient as to merit the evaluation which you gave it.

For papers graded 3 no checks under "Reasons for Evaluation" are necessary.

Forty to fifty compositions from each of the grade IV and grade VII samples were submitted to a panel of experienced judges who evaluated them independently. When there was complete agreement by all of the judges, two scales²—one for grade IV and one for grade VII—were prepared and mimeographed.

Using these scales, selected students registered in the Faculty of Education, University of Alberta, evaluated the quality of the compositions in both the grade IV and grade VII samples. Each paper was evaluated independently by three students, and the average evaluation (rounded to the nearest whole number) calculated. The score values thus determined were used in making the analyses and comparisons of the quality of the compositions in the study.

Mechanics and usage. Each composition was scored according to the following instructions:

In the left hand margin of the student's paper place the letter *S* for each error in spelling, the letter *P* for each error in punctuation, and the letter *U* for each error in grammar and usage. Total the spelling, punctuation, and grammar and usage errors, and place the totals in the boxes on the record card. In the box to the right of these enter the value on usage and convention by using the following conversion scale:

Value 5—no errors

Value 4—1, 2 or 3 errors

Value 3—4, 5 or 6 errors

Value 2—7, 8 or 9 errors

Value 1—more than 9 errors.

Accept any legitimate spelling of a word. Count as an error in spelling the omission of the capital from proper nouns but not the omission of the capital at the beginning of the sentence. Count also as errors the capitalization of a word which does not require such capitalization.

Only those punctuation errors should be counted which are definite breaches or which distort the meaning. Count as errors in punctuation the omission of a capital at the beginning of a sentence. Do not count as punctuation errors the comma splice since this is really related to sentence organization rather than punctuation.

²These scales are reproduced in the Appendix to this Journal, pages 53-61.

Count as errors in grammar and usage only those items which are unacceptable in standard informal English. Use Perrin's *Writer's Guide and Index to English* and either Webster's *Collegiate Dictionary* or the *American College Dictionary* as sources against which to check usage.

In addition a count was made of the spelling, punctuation, and usage errors on all of the papers in both the grade IV and the grade VII samples.

Correlations

The intelligence score, the total score on the California Language Test, the *quality* score, and the *mechanics* score were recorded for each student. These data were then compiled and analyzed, the statistical computations being done by graduate students under the guidance of Dr. G. M. Dunlop.

Written Expression in Grade Four

Quality

Table I shows the distribution of quality scores for all pupils in the grade IV sample. Of this sample 3.8 per cent (34 students) received a score of five, 24.3 per cent a score of four, 46.4 per cent a score of three, 22.2 per cent a score of two, and 3.3 per cent a score of one. The highest mean score was obtained by the city subsample. The town, graded rural, and ungraded rural subsamples follow in that order.

TABLE I
QUALITY SCORES, MEANS, AND STANDARD DEVIATIONS
FOR FOUR SUBSAMPLES OF ALBERTA GRADE
FOUR PUPILS

Sample	Scores					Number of Students	Mean	Standard Deviation	Standard Error
	5	4	3	2	1				
City	19	88	152	63	6	328	3.167	0.828	0.046
Town	7	62	92	35	5	201	3.154	0.835	0.059
Graded Rural	3	37	89	50	7	186	2.887	0.819	0.060
Ungraded Rural	5	79	29	49	11	173	2.815	0.887	0.067
TOTAL	34	216	412	197	29	888	3.033	0.865	0.029

The means shown in Table I were variously paired and their significance tested by the Cochran and Cox approximate method. Table II shows these differences, together with the standard errors of the differences between pairs, the observed *t* values, and significant differences between pairs.

TABLE II
COMPARATIVE ACHIEVEMENT IN QUALITY OF WRITTEN
COMPOSITION OF GRADE FOUR PUPILS EXPRESSED
AS MEAN DIFFERENCES

Sample	Town	Graded Rural	Ungraded Rural	Total Sample
CITY				
Dif.	0.013	0.280	0.352	0.134
SE _D	0.075	0.076	0.082	0.054
t	0.174	3.702	4.309	2.407
Sig. ....	.....	.01	.01	.05
TOWN				
Dif. ....	.....	0.267	0.339	0.121
SE _D ....	.....	0.089	0.090	0.066
t ....	.....	3.166	3.776	1.839
Sig. ....	.....	.01	.01	.....
GRADED RURAL				
Dif. ....	.....	.....	0.072	—0.146
SE _D ....	.....	.....	0.091	0.067
t ....	.....	.....	0.795	2.184
Sig. ....	.....	.....	.....	.05
UNGRADED RURAL				
Dif. ....	.....	.....	.....	—0.218
SE _D ....	.....	.....	.....	0.074
t ....	.....	.....	.....	2.962
Sig. ....	.....	.....	.....	.01

The means of the city and town subsamples are significantly greater than those of the graded rural and ungraded rural subsamples at the .01 level. Other differences between pairs are not statistically significant.

The above indications may be confirmed by reference to the mean of the total sample, which is significantly smaller than that of the city subsample and significantly greater than the means of both graded rural and ungraded rural subsamples.

Mechanics and Usage

Table III shows the distribution of scores in mechanics and usage for all pupils in the grade IV sample. Of this sample 6.1 per cent (54 students) received a score of five, 37.6 per cent a score of four, 33.9 per cent a score of three, 13.9 per cent a score of two, and 8.5 per cent a score of one. The highest mean score in mechanics was shared by the city and town subsamples. The graded rural and ungraded rural subsamples follow in that order.

TABLE III
MECHANICS SCORES, MEANS, AND STANDARD DEVIATIONS FOR FOUR SUBSAMPLES OF ALBERTA GRADE FOUR PUPILS

Sample	Scores					Number of Students	Mean	Standard Deviation	Standard Error
	5	4	3	2	1				
City	18	134	111	45	20	328	3.259	0.990	0.054
Town	18	75	65	27	16	201	3.259	1.057	0.075
Graded Rural	12	76	58	28	12	186	3.258	1.004	0.074
Ungraded Rural	6	49	67	24	27	173	2.902	1.084	0.082
TOTAL	54	334	301	124	75	888	3.189	1.030	0.034

TABLE IV
COMPARATIVE ACHIEVEMENT IN MECHANICS AND USAGE OF GRADE IV PUPILS EXPRESSED AS MEAN DIFFERENCES

Sample	Town	Graded Rural	Ungraded Rural	Total Sample
CITY				
Dif.	0.000	0.001	0.357	—0.070
SE _D	0.093	0.092	0.099	0.065
t	0.000	0.010	3.600	1.081
Sig.			.01	.....
TOWN				
Dif.		0.001	0.357	0.070
SE _D		0.105	0.111	0.082
t		0.101	3.205	0.850
Sig.			.01	.....
GRADED RURAL				
Dif.			0.356	0.069
SE _D			0.111	0.082
t			3.210	0.859
Sig.			.01	.....
UNGRADED RURAL				
Dif.				—0.287
SE _D				0.090
t				3.203
Sig.				.01

Table IV compares the achievement of the four subsamples in terms of mean differences. The mean of the ungraded rural subsample is significantly smaller (.01) than that of the total sample and of the other subsamples.

Written Expression in Grade Seven

Quality

Table V shows the distribution of quality scores for all pupils in the grade VII sample. Of this sample 2.1 per cent (19 students) received a score of five, 19.1 per cent a score of four, 48.5 per cent a score of three, 26.3 per cent a score of two, and 3.9 per cent a score of one. The highest mean score was obtained by the city subsample. The town, graded rural, and ungraded rural subsamples follow in that order.

TABLE V
QUALITY SCORES, MEANS, AND STANDARD DEVIATIONS
FOR FOUR SUBSAMPLES OF ALBERTA GRADE
SEVEN PUPILS

Sample	Scores					Number of Students	Mean	Standard Deviation	Standard Error
	5	4	3	2	1				
City	9	68	162	81	10	330	2.955	0.824	0.045
Town	5	40	115	47	7	214	2.949	0.793	0.054
Graded Rural	2	31	81	49	6	169	2.846	1.032	0.079
Ungraded Rural	3	31	75	58	12	179	2.749	0.877	0.066
TOTAL	19	170	433	235	35	892	2.891	0.827	0.028

Table VI compares the achievement of the four subsamples in terms of mean differences. The means of the city and town subsamples were found to be significantly greater than the mean of the ungraded rural subsamples (.05). The latter was found to be significantly smaller than the mean of the total sample (.05).

Mechanics and usage

Table VII shows the distribution of scores in mechanics and usage for all pupils in the grade VII sample. Of this sample 3.6 per cent (32 students) received a score of five, 25.9 percent a score of four, 31.3 per cent a score of three, 18.3 per cent a score of two, and 20.9 per cent a score of one. The highest mean score was obtained by the city subsample. The town, ungraded rural, and graded rural subsamples follow in that order.

TABLE VI
COMPARATIVE ACHIEVEMENT IN QUALITY OF WRITTEN
COMPOSITION OF GRADE VII PUPILS EXPRESSED AS
MEAN DIFFERENCES

Sample	Town	Graded Rural	Ungraded Rural	Total Sample
CITY				
Dif.	0.006	0.109	0.206	0.064
SE _D	0.071	0.092	0.080	0.053
t	0.085	1.079	2.578	1.205
Sig. ....	.....	.....	.05	.....
TOWN				
Dif. ....	.....	0.103	0.200	0.058
SE _D ....	.....	0.096	0.085	0.061
t ....	.....	1.068	2.346	0.951
Sig. ....	.....	.....	.05	.....
GRADED RURAL				
Dif. ....	.....	.....	0.097	—0.045
SE _D ....	.....	.....	0.103	0.089
t ....	.....	.....	0.940	0.534
Sig. ....	.....	.....	.....	.....
UNGRADED RURAL				
Dif. ....	.....	.....	.....	—0.071
SE _D ....	.....	.....	.....	1.990
t ....	.....	.....	.....	1.968
Sig. ....	.....	.....	.....	.05

TABLE VII
MECHANICS SCORES, MEANS, AND STANDARD
DEVIATIONS FOR FOUR SUBSAMPLES OF ALBERTA
GRADE SEVEN PUPILS

Sample	Scores					Number of Students	Mean	Standard Deviation	Standard Error
	5	4	3	2	1				
City	16	95	107	53	59	330	2.867	1.156	0.064
Town	8	53	73	36	44	214	2.743	1.150	0.079
Graded Rural	3	35	54	42	35	169	2.578	1.086	0.084
Ungraded Rural	5	48	45	32	49	179	2.598	1.222	0.091
TOTAL	32	231	279	163	187	892	2.729	1.162	0.039

Table VIII compares the achievement of the four subsamples in terms of mean differences. The mean of the city subsample was found to be significantly greater than the means of the graded rural (.01) and ungraded rural (.05) subsamples.

TABLE VIII
COMPARATIVE ACHIEVEMENT IN MECHANICS AND
USAGE OF GRADE VII PUPILS EXPRESSED AS
MEAN DIFFERENCES

Sample	Town	Graded Rural	Ungraded Rural	Total Sample
CITY				
Dif.	0.124	0.289	0.269	0.138
SE _D	0.099	0.103	0.110	0.072
t	1.246	2.794	2.445	1.911
Sig. ....	.....	.01	.05	.....
TOWN				
Dif. ....	.....	0.165	0.145	0.014
SE _D ....	.....	0.115	0.121	0.088
t ....	.....	1.436	1.200	0.159
Sig. ....	.....	.....	.....	.....
GRADED RURAL				
Dif. ....	.....	.....	—0.020	—0.151
SE _D ....	.....	.....	0.124	0.092
t ....	.....	.....	1.612	1.635
Sig. ....	.....	.....	.....	.....
UNGRADED RURAL				
Dif. ....	.....	.....	.....	—0.131
SE _D ....	.....	.....	.....	0.099
t ....	.....	.....	.....	1.312
Sig. ....	.....	.....	.....	.....

Intercorrelations

Using measures of intelligence, language achievement on the California Language Test, scores on the quality of written composition and on mechanics and usage, intercorrelations were calculated as shown in Table IX.

Although none of these figures are high, all are positive. Further reference will be made to them below.

TABLE IX
INTERCORRELATIONS AMONG SCORES ON INTELLIGENCE,
CALIFORNIA TEST, QUALITY OF WRITTEN COMPOSITION,
MECHANICS AND USAGE

Correlated Measures	Grade IV			Grade VII		
	California Test	Quality	Mechanics	California Test	Quality	Mechanics
Intelligence	.55	.41	.33	.70	.44	.36
California Test .....	.....	.46	.42	.....	.55	.50
Quality .....	.....	.....	.26	.....	.....	.40

Errors in Mechanics and Usage

A count of the errors in spelling, punctuation and grammar was made for a slightly larger sample of Alberta grade IV and VII pupils (934 and 938 respectively). Figures 1 and 2 show the results of this count. Further reference to these data will be made below.

Interpretations and Conclusions

Achievement in urban and rural schools

A summary of the relative achievement of city, town, and rural pupils in written composition is provided in Table X. In general, the relationship of these scores is comparable to that in reading found by Carmichael and Rees.³ Their analysis of possible reasons for the relationship is applicable to the present study.

Differences in intelligence may well be one factor. Reid found that mean scores for intelligence of the pupils in the Alberta sample ranked downward from city, through town and graded rural to ungraded rural subsamples.⁴ The correlations between quality, mechanics, and intelligence shown in Table IX are positive, though not high.

If intelligence is a factor, it may be in some measure a function of the pupil's environment. Cultural opportunities in many rural areas are necessarily less than in towns and cities. This is especially true of the kinds of opportunity that lead to expertness in communication: the development of verbalism bears clear relationship to the breadth of social contacts and the richness and appropriateness of available printed material. While the radio is

³Carmichael and Rees, *op. cit.*, pp. 25-26.
⁴Reid and Conquest, *op. cit.*, pp. 45-46.

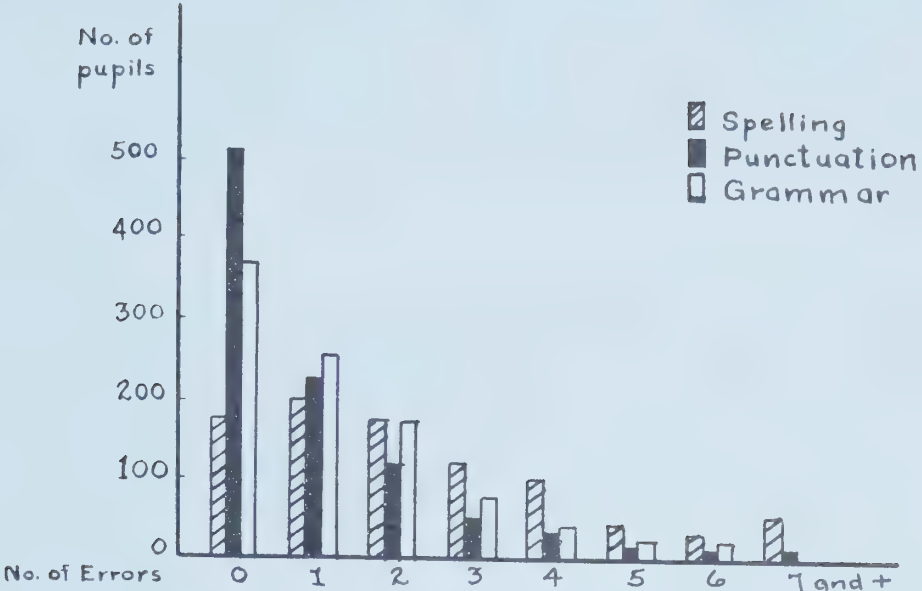


FIGURE 1. Number of errors in spelling, punctuation and grammar of a sample of 934 grade IV pupils.

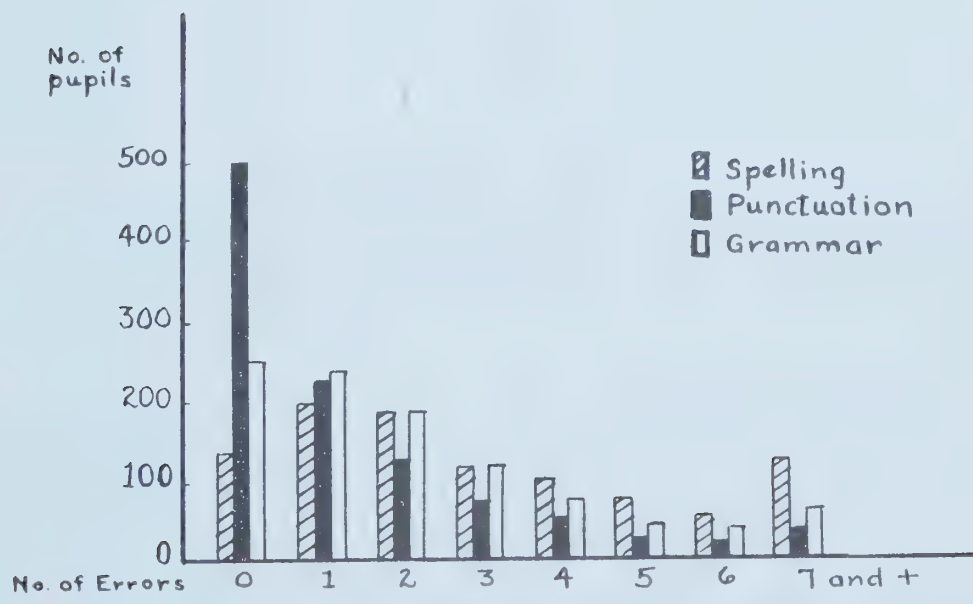


FIGURE 2. Number of Errors in spelling, punctuation and grammar of a sample of 938 grade VII pupils.

broadening the listening experiences of rural children, and while centralization and vanning are providing wider social contacts for them, it is doubtful whether their advantages are yet equal to those of town and city children.

The probability of a higher proportion of the foreign born in rural than in urban Alberta suggests a second and obvious explanation for differences in language scores. It might also suggest, in terms of the language handicap, an explanation for differences in intelligence scores.

TABLE X
SUBSAMPLES WITH MEAN SCORES SIGNIFICANTLY
HIGHER THAN THOSE OF OTHER SUBSAMPLES AND
OF THE TOTAL SAMPLE

Subsample	Grade IV		Grade VII	
	Quality	Mechanics	Quality	Mechanics
City	GR (.01) UGR (.01) TS (.05)	UGR (.01)	UGR (.05)	GR (.01) UGR (.05)
Town	GR (.01) UGR (.01)	UGR (.01)	UGR (.05)	..... .....
Graded Rural .....	.....	UGR (.01)	.....	.....

NOTE: GR—graded rural; UGR—ungraded rural; TS—total sample.
The table is to be read as follows: For grade IV, the mean *quality* score of the city subsample is significantly higher than that of graded rural and ungraded rural subsamples at the .01 level of confidence, and of the total sample at the .05 level; the mean *mechanics* score is significantly higher than that of the ungraded rural subsample at the .01 level.

The foregoing are relatively inflexible circumstances associated with the opening up of a new country. Teaching competency is—potentially at least—more controllable, and this competency may be a third factor. At any rate, it justifies conjecture with reference to differences in the scores of urban and rural students. Generally speaking, teachers with higher qualifications do seek and find employment in towns and cities. (It has been said with some truth that the rural divisions staff the city schools.) More attractive living and working conditions would encourage more superior rural teachers to remain in rural areas. An increase in teacher recruits from cities would tend to fill more of the available jobs there, further reducing the drain of competent rural teachers.

Achievement in grade IV and grade VII

The pattern of significant differences at the grade VII level is not so distinctive as at the grade IV level. There seems to be no clear reason for this finding. Perhaps three more years of school and community influence (as opposed to more exclusive and differential home contacts in the early school years) tend to level language facility.

Intercorrelations

It has already been pointed out that the correlations among scores on intelligence, the California Language Test, quality, and mechanics⁵ are all positive but rather low. They are certainly too low to justify prediction or generalization with reference to the primary purposes of this study. They do, however, tend to confirm the view that achievement in mechanics and usage has less to do with intelligence than does the quality of ideas and their expression.

Spelling, punctuation, and grammar

The data presented in Figures 1 and 2 are based on an average of approximately 100 words for compositions in grade IV, and of 200 words for those in grade VII. In grade IV, in a random sample of 934 students, about 180 had no errors in spelling, 200 had only one, and 175 had two; in punctuation, some 515 of the 934 had no errors at all; in usage and grammar, 375 had no errors. In grade VII, more than 500 of the 938 students ranged from no errors to two errors in spelling, 420 had no errors in punctuation, and more than 650 had from no errors to two errors in grammar and usage.

These are encouraging figures. They suggest that large numbers of our students are writing mechanically correct English, and that their usage patterns are respectable.

Evaluating student writing

After experience with evaluation procedures in this study, much can be said in favour of a two-phase evaluation of student writing. This implies only in part the distinction between so-called "subjective" and "objective" procedures. It has more to do with the distinction between sense or spirit (quality) and form (mechanics)—a vital distinction, not only for purposes of accurate evaluation but for the much more important goals of criticism and improvement.

Evaluation for quality means the assessment of ideas and their presentation in terms of their sheer impact as communication (selection, organization, diction). Evaluation for mechanics means the assessment of formal facility or correctness (punctuation,

⁵See pages 13-14.

spelling, usage). The use of a check sheet may help in each of these processes, but it must be kept simple and uncomplicated. Otherwise the process of evaluation tends to degenerate into mere mathematical processes of addition and subtraction. For the evaluation of quality, the development of local scales has been found highly desirable.

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Patricia A. McFetridge

Editor, December 1967-September 1969

Mathematics Learning in Young Children

It is a pleasure to participate in this special issue of AJER featuring previously published outstanding research. I have selected an article by Sawada and Nelson for its significance as the beginning of important studies in mathematics learning in young children.

From this early study each author developed a long program of outstanding research into the nature of concept formation and mathematical understandings in young children, a field relatively unexplored at that time.

Dr. Nelson's research culminated in the Lecture Series Award from the Faculty of Education, University of Alberta, 1979. He presented a monograph entitled "Studying problem solving behavior in early childhood." Dr. Sawada's later work included a research grant from SSHRC, 1991-1994, for research entitled "Mathematics in a Literary Mode" and to mathematical resources for Division 11 in the schools entitled *Mathworld*. *Mathworld* has been nominated for the 1994 Smithsonian Award from Computerworld.

A modified technique for assessing the child's acquisition of length conservation was designed and tested on 62 subjects aged 5-4 to 8-0. The technique attempted to eliminate or minimize the confounding effects of dependence on verbal means of communication, no understanding of instructions, failure to perceive the initial comparison, forgetting, perceptual estimation and guessing.

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Conservation of Length: Methodological Considerations

Since Piaget's discovery of conservation as a behavioural attribute involved in the child's acquisition of operational thought, many replicative studies have been done confirming the *existence* of the phenomenon of conservation with the result that conservation is generally accepted as a valid attribute in describing the child's cognitive status. These replicative investigations have given way to studies which attempt to relate the phenomenon of conservation to other cognitive variables.^{1,2,3,4,5} However, the techniques used in these later investigations to obtain a measure of conservation are essentially the same as those used in the replicative studies. Unfortunately, techniques useful for showing the *existence* of a phenomenon may be neither precise enough nor powerful enough to establish the relationship of the phenomenon to other variables.

Suppose, for example, that we wished to test a simple hypothesis involving the relation of verbal and nonverbal IQ to the acquisition of conservation of length. Suppose further that we classify students as being conservers or nonconservers on the basis of the "usual" procedure typified by the following:

1. Two rods of equal length are placed in front of S as indicated in Figure 1.
S is asked, "Which stick is longer, or are they both the same length?" Most S will say that they are the "same."



Figure 1.

Rods aligned in "identity position."

2. One of the sticks is transformed (e.g., pushed a few inches to the left or right).
3. S is asked, "Which stick is longer now, or are they still the same length?"
4. Sometimes the question "WHY?" is asked.

In the above procedure there is a heavy reliance on verbal means to communicate to S that he is to respond on the basis of length. In fact, the only way S has of knowing that the attribute under consideration is length is that E used the word "length" or "longer" or some such synonym. Sometimes verbal descriptions, such as "a boy walking along a path" or "two ants going on a walk", are used to communicate to S the criteria he is to use when responding. These verbal descriptions tend to encourage responses based on anthropomorphic criteria which could confound the measure obtained.

If we could couch our description of the criteria of response in a logical rather than a purely verbal form, we could not only give a clearer and more precise definition of the response criteria, but also increase the likelihood that S would respond logically, if, of course, he is capable of doing so. Braine^{6,7,8} has reported studies indicating some of the disadvantages of employing a technique which is crucially dependent on verbal means of communicating the response criteria to S. Smedslund^{9,10} has cast some doubt on Braine's findings, but regardless of the final outcome of the Braine-Smedslund interchange (see Gruen¹¹) it still remains that the measure of conservation derived from the procedure outlined above is so heavily loaded with a built-in verbal factor that its usefulness is severely limited.

Furthermore, such a procedure, dulled as it is by an overlay of verbal dependencies, would probably not possess the necessary sensitivity for detecting the threshold emergence of conservation in young children. In designing training programs for these children it is extremely important that such threshold levels be determined with some degree of precision.

In general, what is needed is a measure of conservation which is maximally free from confounding influences. Such a measure might be called "relatively pure". This paper presents a modified technique for

assessing conservation, and reports, briefly, on an experiment using the technique as a partial evaluation of its effectiveness.

The Problem

In order to design a technique which will give us a relatively pure measure of conservation it would be beneficial to make some basic distinctions concerning the relationship of conservation to concepts in general. At a minimum, we need to distinguish between the concept of a particular attribute (e.g., number, length, time, volume), and the concept of the conservation of the magnitude of that particular attribute. Although the concept of the conservation of the magnitude of an attribute is certainly a part of the concept of the attribute itself, the two are not identical. We are interested only in the conservation aspect of the concept, not in the child's *general* understanding of the attribute.

This basic distinction will be more useful if the following general model for attaining concepts about attributes is adopted. Growth in understanding of a particular attribute can be conceived of as a process of refining a concept already present. With additional refinement, the concept becomes more and more sophisticated. There has to be a starting point, a minimal concept which specifies, rightly or wrongly, when an object possesses the attribute. With respect to the attribute of length, a minimal concept would be that objects take up space, this space being related to the separation of the extremities of the object. More sophisticated concepts would recognize other properties of the expanse between extremities, e.g., that the expanse can change. The recognition of this property would constitute a refinement of the child's concept of length. Other refinements would involve the association of verbal stimuli with the concept. Such words as *big*, *tall*, *high*, *short* and *long* may invoke the concept. The distinction between the words *long* and *high*, *long* and *tall* and so on would be other refinements. A further refinement would be the recognition of the conditions under which the expanse changes, and perhaps concomitantly, the conditions under which the expanse does not change. The acquisition of these last two refinements is fundamental to conservation since, from an experimental point of view, an operational definition of conservation of length could be in terms of the child's success in specifying which actions (transformations) performed on an object will change the length, and which will leave length invariant. It is the acquisition of the last two refinements that is being tested when testing for conservation of length. Whether or not other refinements have been acquired becomes crucial only if such refinements are necessary for the valid use of the testing technique. The measure of conservation will be confounded with these other refinements if the testing technique is based partially on refinements generally acquired after the refinements being tested for.

The above formulation implies, first, that the testing technique should, as far as possible, be dependent only on refinements which occur prior to the refinements being tested for. The second implication is that in order to test any given refinement, E must communicate clearly to S the basic concept underlying the refinement.

The testing technique described in this paper was designed to fulfill these two conditions. In addition, the design was based on the assumption that children in the process of acquiring conservation of length, being somewhere between Piaget's stages of Pre-Operational and Concrete-Operational Thought, feel most comfortable and operate at their highest levels of competence when dealing with concepts embodied in *physical* objects and in *physical* action.

The Technique

It is readily apparent that the "usual" method of measuring conservation of length does not satisfy the requirements of the implications stated above. First, the method assumes that S has acquired the verbal refinement of ideas specified by the word *length*. However, a given S might associate the word length with the location of the extremities of the objects. He would say that the lengths are the same when objects are aligned in identity position (Fig. 1), but he would judge the length to have changed after the transformation was applied since the location of the extremities did indeed change. Such a S would be classified as a nonconservers. Can we be sure that he is a nonconservers, or might the conservation measure be confounded with the verbal requirements?

Second, E has no way of knowing what criteria S is using to decide whether length has changed. E can ask S why he responded as he did, but such a question assumes again that S has acquired verbal refinements related to his concept of length. The technique reported here attempts to overcome these criticisms as well as some other routine sources of error.

In general, the two criticisms can be overcome by (1) using physical apparatus and physical action to communicate to S the attribute under consideration, and (2) enabling S to give his response in a like manner. The objective with respect to (1) is to present S with a precise definition of the attribute under consideration. When the two rods are aligned in identity position (Fig. 1), the location of the endpoints and the lengths of the rods are the same. Hence the rods themselves do not clearly define the attribute under consideration. In fact, *any* attribute which has the same value for both rods in identity position could be the attribute S chooses to consider.

Since all methods for ascertaining conservation involve the process of comparison (either one object with another, or the same object with itself), and since the process of comparison is essentially the basic process

involved in measurement, the definition of the attribute could be made more precise by making the process of comparison explicit. Since the process of comparison made explicit is simply the process of measurement, the objective can be achieved by *measuring* the magnitude of length, and, as with many other cognitive phenomena, letting our measuring device define that which we are measuring.

Toward this end, one of the rods can be the measuring device, and the other the device to be measured. A crude pair of calipers can be made by attaching physical markers to the ends of the rod and affixing a small handle for ease of operation (Fig. 2). S can then be trained to use the calipers as E wishes him to.

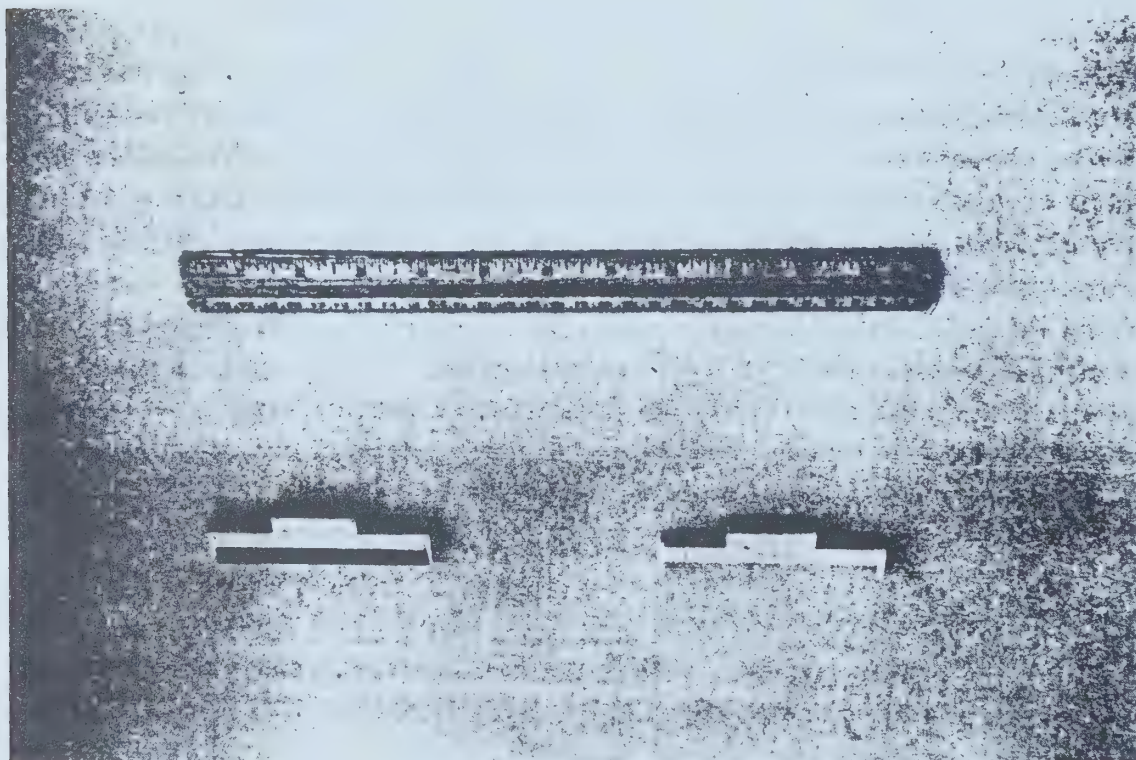


Figure 2.

Two calipers: (left) alone, (right) fitted on an object.

In such a training session, the rods could fit the calipers in only three ways. The rod could be .5 cm. too short for the calipers, just right for the calipers, or .5 cm. too long for the calipers. (Any appropriate expanse could have been chosen.) Thus, the three different fits would be defined to S. Not only would the application of the calipers give a physical definition of length, but the three different fits, differing as they do in only one respect, would also help to communicate to S the attribute under consideration. Therefore, the attribute being manipulated would also be the attribute under consideration. Zimiles¹² has pointed out that many

procedures include so much manipulation of irrelevant variables that S may not be aware of the correct criterion to use in responding. For example, the manipulation of the length of a row of checkers when the attribute under consideration is number may lead S to infer that E really wants him to respond on the basis of length.

The second major objective of the proposed technique is to enable S to use the physical apparatus (1) to facilitate his decision-making about the changes in the magnitude of the attribute, and (2) to communicate his decision to E. The three different fits previously distinguished can be used to accomplish this second objective as well as the first. A three-choice response apparatus could be constructed so that each fit is associated with one of the choices (Fig. 3). The following sequence could then be carried out. A rod and calipers are placed in front of S. S inserts the rod in the calipers (or applies the calipers to the rod) noting the fit. E then removes the calipers and applies a transformation to the rod. S *predicts* how the calipers will fit on the transformed rod by making one of the choices on the response apparatus. Embodied in his choice is his decision about the effect of the transformation on length. Once S understands what is required of him, and this can be accomplished through a training session, there need be no verbal exchange between S and E.



Figure 3.

The response apparatus with rods inserted into calipers by S.

The Experiment

In order to test the feasibility of the proposed technique, and to provide some evaluation of its effectiveness, the technique was tried on young children.

Sample

Sixty-four kindergarten and grade one children were randomly selected from a population of 196 such children attending two schools servicing the Canadian Armed Forces Barracks at Griesbach near Edmonton, Alberta. Most of the fathers were enlisted men of the Corporal or lower rank. Two of the S's had to be excluded from the study: one because he could not meet one of the criteria in the training session and the other because of illness.

Apparatus

There were three major parts to the apparatus: (1) calipers, (2) objects possessing the attribute of length, and (3) a response apparatus.

The calipers were of three magnitudes: 9 cm., 9.5 cm., and 10 cm. The objects were of three kinds—plasticine, wood, and cigarettes—and ranged in length from 1 cm. to 10 cm. The objects could easily be combined to give composite objects possessing "multiple segmented lengths". The response apparatus had 3 doors, each of which could display a candy reward when opened. As suggested earlier, the rods (objects) always fitted the calipers in one of three ways: the rod was .5 cm. too short for the calipers, the rod was just right for the calipers, or the rod was .5 cm. too long for the calipers. The association between each of these fits and the appropriate door on the apparatus was facilitated by placing a "model fit" above the door.

Procedure

Each S was tested individually by the investigator in a session which lasted from 30 to 40 minutes per S. First S was trained and then tested.

The Training Session: As can be gathered from remarks made previously, the crucial part of the technique lies in communicating clearly to S precisely what is required of him and how he is to use the apparatus to make decisions and communicate them to E. Therefore, a detailed account of the training session is given here.

The training session, which lasted from 7 to 12 minutes, had four specific objectives: (1) to train S how to use the calipers, (2) to train S to distinguish among the three kinds of fits, (3) to train S to associate each type of fit with one of the doors on the response apparatus, and (4) to train S to predict the fit of the calipers after E had given the object a transformation.

Objective 1: S was seated in front of the response apparatus (Fig. 3). S was asked if he had ever played with the material on the table and invariably S said no. "Let me show you how." E picked out a 9 cm. caliper and (4, 3, 2)* rods and placed them on the table with one of the rods on end. "We try to push these (pointing to calipers and pushing them slightly toward the rods) onto these sticks." After a slight pause, E said, "But, to make it easier we do this first. We lay the sticks down like this (upright stick is laid horizontally), and put them along here (along the front edge of the box containing the rods) nice and close (gaps are closed between sticks) in a straight line." E brings the sticks back into random formation and says, "Now you try it." Every S could arrange the rods properly. "Now see if you can push these on." S pushes the calipers on and is assisted if necessary. "Those rods fit nicely, don't they? Here, let's try these (9.5 calipers; 5, 3, 2 rods)." Several other examples were given illustrating the three different kinds of fits, thus leading to the next objective.

Objective 2: S was asked if all the sticks fit the same and invariably all S said no. S was encouraged to verbalize the differences in the three fits, but if he did not, he was not urged. If S did volunteer words to describe the fits, then E used S's terminology when referring to the various fits.

Objective 3: After distinguishing the three fits, S's attention was directed toward the three calipers lying on the response apparatus, each of the calipers with an accompanying rod placed parallel to it and about an inch from the calipers. S was directed to place each caliper onto its accompanying rod, and all S agreed that each fit was different. E asked S to tell or show him how they were different, and again E did not insist on verbal replies. S was shown the doors directly below the model fits and how they opened. The one-to-one correspondence between the doors and the fits was established by the designation by E of a fit (either by pointing or by using S's terminology) and the opening of the corresponding door by S.

E then placed calipers and rods in front of S and S applied the calipers. "Which one of these is it like?" If S designated the proper model fit, E asked, "Then which door are you going to open?" If S designated the wrong fit, he was told to look closely and try again. All incorrect designations were the result of hasty and imprecise applications of the calipers, and after trying again these S's realized that they had to apply the calipers carefully if they were to open the "correct" door and find the candy reward. Thus S was aware that close observation of the fit was necessary. S was then asked if he thought there would be candies behind the other two doors, and was invited to try them. There were no candies behind

*Denotes a 4 cm. rod, 3 cm. rod, and a 2 cm. rod.

the wrong doors. S was encouraged to verbalize as to why not, and again E did not insist.

Several other combinations of calipers and rods resulting in different fits were tried, and after S made 4 consecutive correct responses (i.e., found the candy), the final phase of the training session was begun. All except one exceptional S could meet the criterion of 4 consecutive correct responses, and all S took 7 or fewer trials ($p = 4/81$, at a maximum). The exceptional S, who had a very low IQ, was excluded from the study.

Objective 4: At this stage, all S agreed that it was easy to find the candy, as indeed it was. "Well since it's so easy, I'm going to change the game so that it's not quite so easy, and this time you can keep the candy when you find it. I'll show you what we're going to do; watch closely so that you'll be able to find the candy. We're going to do three things. First you put the calipers on the sticks just as before (S does so). Next I'm going to do something to the sticks (E removes the calipers and transforms the sticks). Now if you put these (calipers) on again in the way you always do, would they be like this, or this, or this (pointing to model fits)?" Some S pointed at a model fit, but some started to put the calipers on again. For those who pointed at a fit E said, "Where's the candy going to be then? Find it." If S found the candy he was told, "Yes, that's right. That's what it would look like." If S failed to find the candy (i.e., designated the wrong fit) he was told, "No, I guess it wouldn't be that one. It would be like this one or that one." (Parenthetically, it should be noted that up to this point the general objective has been to specify to S that length is the attribute under consideration. It now remains to specify to S that the refinement of conservation is the crucial variable.) For those S who started to put the calipers on the rods, E interrupted and said, "That would make it too easy if I let you do that. I want you to tell me what it would look like without having to put these on. Would it be like this, or this, or this?"

All S were required to do additional examples and all S appeared to grasp what was required of them. In the additional examples E inserted the sentence, "You saw what I did to the sticks. What's it going to look like now, this, or this, or this?" In an attempt to prevent the child from getting the idea that he merely had to choose the original fit again, two of the transformations used changed the length of the rods. The test itself was then begun.

The Test

The 24 test items were given in exactly the same manner as the last examples in the training session. Sixteen of the transformations left length invariant, while eight changed the magnitude of length. The transformations consisted of such actions as (1) rotating the rod(s),

(2) translating the rod(s), (3) adding or subtracting a portion of the rod(s), (4) rolling the plasticine rod, thus elongating it, and (5) cutting a portion of the filter off a cigarette (or adding it on).

Administration of the test: An attempt was made to minimize the confounding influence of several variables:

1. Guessing. In a multiple choice context, guessing plays a prominent role. To counteract its effect, each of the three doors led to a candy reward an equal number of times (8, 8, 8); twenty-four items were used instead of the usual three or four; and S was told that if he was careful and watched what E did to the rods, he could find the candy *every time*.

2. Perceptual estimation. To counteract perceptual estimation the calipers were at no time left in a position parallel to the rods. After removing the calipers, E usually held them partially concealed in his hand, or laid them perpendicular to the rods when possible.

3. Disinterested performance. The use of candy rewards, the novelty of the apparatus and of the technique, along with the active involvement of S throughout the testing session helped to overcome lack of interest.

4. Forgetting. It was crucial that S remember how the rod fit before the transformation was applied. To minimize the role of forgetting, any time that S appeared to forget the initial fit E said, "Did you forget how it fit before? It looked like this one. You saw what I did to the sticks. Which one do you think it's going to be now? Find the candy." Moreover, S was informed that if he ever forgot, he should ask E.

Results

In order to assess the feasibility and effectiveness of the technique it was assumed that if the technique did in fact remove several confounding influences, then the removal of such confounding influences should be reflected in the increased success that younger children would experience with the technique as compared with the success they would have with the usual method. In discussing the age of acquisition of concrete-operational thought processes, Braine^{13,14} and Smedslund^{15,16} reported their results as threshold ages determined by finding the age interval for which 50% of the subjects in the interval possess the thought process. On this basis they estimated, for Piaget's¹⁷ results, the threshold age for the acquisition of conservation of length to be between 7 and 8 years of age. Murray¹⁸ reported similar threshold ages. Thus, on the basis of the rationale presented here, the effectiveness of the proposed technique can be determined by testing the hypothesis that the technique will result in a significantly lower threshold age for the acquisition of conservation of length.

Before any results concerning the threshold age can be reported, criteria to determine when a given S can be considered a conserver must

be specified. In most tests of conservation, the decision-making process which confronts S can be conceived of as essentially a process of classification. S has to classify the transformations applied to the objects into two mutually exclusive categories: those transformations which leave length invariant and those transformations which change the magnitude of length. In this kind of situation, guessing would give 50-50 results. For the technique used in this study, the involvement of three different fits made possible a finer classification of transformations: those which decreased length, those which left length invariant, and those which increased length. A conserver was one who could classify the transformations correctly in these three categories.

Assuming that all important confounding influences were controlled, and since a three-way response apparatus was used, the probability of a correct response from a nonconserver is no more than one in three. For the purposes of reporting results, the 16 test items which left length invariant were divided into two sets of 8, one involving rotations and the other translations. Each of these sets of 8 was combined with the 8 items which did not leave length invariant. Thus, there were two overlapping subtests of 16 items each. Since half of the items in each subtest changed the magnitude of length, the probability was minimized that any S would maintain the strategy of responding on the basis that the fit after the transformation would be the same as the fit before the transformation.

With $\theta = 1/3$ and $N = 16$, a score of 11 correct responses would be significantly better than chance at the .01 level using the binomial distribution.

Table 1 shows, for each subtest, the number and percentage who reached the criterion in each age interval. Data presented in the table indicate that the threshold age for conservation of length, using the proposed technique, is somewhere between 5-4 and 6-2. These ages are about 2 years lower than those obtained using the usual technique. The hypothesis concerning the effectiveness of the proposed technique is therefore accepted.

Discussion and Summary

A modified technique for assessing the child's acquisition of the conservation of length was presented and evaluated. An attempt was made to control for the following confounding influences: guessing, perceptual estimation, misunderstanding of instructions, misconception of the response criteria, failure to perceive the initial comparison of lengths (perception of the initial "fit"), forgetting the initial comparison, lack of a nonverbal way of expressing decisions, and disinterested performance.*

Perhaps the strongest modification in the proposed technique is the use of physical apparatus to make the technique highly concrete and

*Based on Smedslund's analysis (1963).

more precise, thus overcoming the vagueness and imprecision associated with children's language. However, a price must be paid for introducing such precision, the price being embodied in the logical relations built into the use of the apparatus. The crucial question is whether the dependence on a minimal logical competence is more confounding than the dependence on a minimal verbal competence. Since the experiment resulted in threshold ages about 2 years lower than the usual ages, it is concluded that when the required logic is embodied in concrete operations with physical apparatus, the young child is better able to reveal his threshold acquisition of cognitive processes.

TABLE I
ACQUISITION OF THE CONSERVATION OF LENGTH WITH RESPECT TO AGE

Age Group	No. of Ss	Subtests Serving as Criteria			
		Rotations and Non-Inv		Translations and Non-Inv	
		N	%	N	%
7-2 to 8-0	15	14	93	15	100
6-3 to 7-1	22	19	86	17	77
5-4 to 6-2	25	19	76	16	64

Note: 1. Ss were classified as conservers if the number of correct responses they gave on a particular criterion was significant at the .01 level.
2. "N" designates the number of Ss with conservation.
3. "%" designates the percentage of Ss with conservation.

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Individualizing Learning

A significant development in educational research in Alberta occurred in the late 1960s with the establishment of the Human Resources Research Council. Although the mandate of the Council included all types of social science research, the major initial thrust was the research and development program in education. A specific aspect of the program focused on exploring means of individualizing learning. In the Individually Prescribed Instruction (IPI) Project, materials for mathematics developed at the University of Pittsburgh were field tested in three schools. The venture into research and development brought with it the need to design ways of evaluating such activities.

In his informative article "Evaluation of the IPI Project," Maguire describes the comprehensive approach taken to evaluating the Project. At the time, the challenges of conducting evaluation research were well documented in the literature. But examples of how sound evaluations might be conducted under less than ideal conditions were lacking. The article by Maguire helped to fill the gap and continues to stand as an example of how to conduct evaluation research. The approach taken is noteworthy for the breadth of perspective that encompasses both process and outcomes, for the comprehensive methodology that includes both quantitative and qualitative strategies, for the attention given to collecting data from wide-ranging sources, for the use of varied data collection techniques, for the thorough manner in which the results are presented, and for the balanced and thoughtful interpretation of results. The evaluation must have been helpful to all stakeholders in the project as well as to other researchers.

No doubt the article would have been even more influential on the local scene if the research and development activities such as the IPI Project had not ended abruptly because the Human Resources Research Council failed to survive a change of provincial governments in the early 1970s.

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Evaluation of The IPI Project

The evaluation of the IPI mathematics project in three Alberta schools is described. Data were collected on student achievement, student attitudes, teacher attitudes and parents' opinions. In a comparative study of student achievement, the results tended to favor the set of Control schools. In areas of student and teacher attitudes the reverse was true. Parental opinions were found to be generally favorable to the program. Project administrator reports are described and implementation problems are discussed. The present paper is a much-shortened form of a report presented to the Alberta Human Resources Research Council.

In the spring of 1969, three schools were selected as sites for the establishment of demonstration/testing centres for IPI Mathematics. Two urban schools were selected as representative of two broad socio-economic classes. One of the schools served a predominantly lower middle class neighbourhood while the other urban school was located in an upper middle class area. A third school was selected to represent the rural situation. The three school systems in whose jurisdiction the demonstration schools fell were asked to nominate a second school which most nearly matched the demonstration school in terms of facilities and area served. In the report that follows, these schools will be referred to as Control schools, although it is important to realize that from an experimental point of view, they could not be considered as equivalent to the IPI schools in any more than a general way.

In September of 1969, IPI mathematics was installed in the three IPI schools. As the project developed the major emphasis was placed on the third objective. In line with this, the evaluation activities were also concentrated on investigating the applicability of the IPI Mathematics system to Alberta schools. To this end, during the first year the evaluators undertook to examine IPI mathematics from two points of view, process and outcome.

Two broad procedures were used in the evaluation. Comparisons were made between the IPI and Control schools on many of the variables. In addition, and perhaps more importantly, observations, opinions and judgements were elicited from students, teachers, parents and administrators in the IPI schools.

Achievement data, and some attitude data were collected in October of 1969, and again in May of 1970, in an effort to detect changes that might have occurred during the first year of the project. Interviews with teachers and parents were made during February of 1970, after they had a chance to get by the initial disruption of installation, and had experienced enough of the program to form valid opinions. All of the results presented in this report refer to the first year of the project.

Process Evaluation

Two kinds of processes were involved in the IPI Project. The first process consisted of the installation of IPI in the schools. The data concerning this process were the observations and opinions of two of the administrators who had responsibility for running the program. A qualitatively different kind of process was investigated by looking at the activities in the classroom themselves. A comparative study of the teacher-student interactions was made to see if any differences in classroom processes were detectable.

Evaluation of Program Implementation

Pacey (1971a) and Holmes (1971), two of the administrators involved in the implementation of IPI, maintained sets of notes describing the problems and successes that were encountered in the application of IPI during the first year. From their reports, several interesting results were noted.

During the first month of operation, all of the children had to be placed on the IPI continuum. This required the testing of all of the children to determine the level at which they should enter the program. The procedure proved to be tedious and often exhausting, but since complete placement testing is only required when the program is first introduced to the school, the task was a bearable one. In succeeding years, September placements for most students can be made on the basis of their June locations on the continuum.

Also, in the first month, the schools needed extra help in carrying out the many tasks of recording, prescribing, testing, marking, and distributing materials. Because the teachers were not yet intimately familiar with the materials, more than the usual help was needed. The school administrators spent a considerable amount of time in the classroom working with the teacher and students in an effort to alleviate the problem. This not only provided the extra manpower necessary to overcome the initial starting pains, but had the side effect of promoting a spirit of unity among the staff.

Because of the magnitude of the individualization task, the first month was particularly inefficient for the students as well. Some students spent as much as three quarters of their time standing in line, waiting to have materials corrected or assigned. Two solutions to this problem were used. The children themselves were given more responsibility in marking their own work, and obtaining materials from the storage rooms. Secondly, since the city schools

obviously needed more teacher assistance for the clerical chores, parent volunteers were obtained from the communities. Typically two volunteers were used in each math class.

Among the other initial difficulties was the problem of the placement tests. Children who had grown accustomed to the traditional purposes of testing, often had difficulty accepting "failure" in placement testing. However, after a month's experience with the program, their understanding of the role of the placement test allowed them to see it in its proper perspective.

The administrators of the IPI program in each school were trained at a demonstration school in the United States. At that school, the IPI guidelines were rigidly adhered to. Within the Alberta situation, no attempt was made to follow the guidelines exactly. The teachers of each school tried to fit the program into the contexts of their own situation. In grade one for example, one school used the IPI materials from the outset, but used additional mathematics readiness materials at the same time. At another school the children in grade one were phased into the program in three groups as they became ready. In general the teachers tried to follow the IPI program, but felt free to deviate from the enunciated procedures whenever their professional judgement dictated it.

The effects on the children, as observed by the administrators was important. Almost all of the children were excited by the program. Undoubtedly some of this could be attributed to the novelty of the program, but that is not necessarily a bad thing. There were no new discipline problems caused by the increase in freedom, and some of the old problems (a few of the so-called lazy children) seemed to disappear. Some of the children were bewildered and frustrated by the complex system, but the number was not nearly as many as the staff had expected. The vast majority of the students adjusted quickly and enjoyed their work so much that they were reluctant to be taken out of their booklet work to work on some enriching activities in seminars. There seemed to be a lingering competitiveness that made some of the children push to keep ahead of their friends.

For the teachers, the work at the beginning was hard. Later, as they became more accustomed to the system, they began to sense a different kind of problem that was caused by the IPI system. In traditional group teaching situations, individual learning problems are often overlooked in the attempt to achieve some overall mastery by the majority of students. In IPI, the problem does not go away as the student moves from one topic to another, because he cannot move until he has achieved the goal. As a result, teachers were forced to deal with individual learning problems and were astounded by the complexity of the learning process. Despite the difficulties, the teachers were generally positive in their feelings toward the program, although they were critical of many of the specifics of the curriculum.

Five general problems were detected by the administrators.

1. The curriculum materials that were used to teach the money units, all used American coinage; these units were changed to fit the Canadian scene.
2. The project was plagued with problems in shipping, both in terms of late shipments, and improperly filled orders.
3. There were many printing errors in the materials and answer keys.

4. the units designed for the first grade students, required a greater ability to read than most students possessed.

5. Uncertainty in the organization of the funding agency was disruptive of morale in the schools.

In the minds of the participant-observer administrators, these five problems were more than compensated for by the enthusiasm of the learners and teachers.

Classroom Interaction Evaluation

Some critics of IPI suggest that because of the individualized nature of the program, the children lose valuable opportunities for developing social skills. In an effort to determine what differences in classroom interactions existed between the programs, Pacey (1971b) carried out a comparison of the verbal behavior patterns in the experimental and control schools using the Flanders method.

All teachers in grades three to six in all six schools were observed for twenty minutes each. In all there were 16 hours of observation time. The observations were made in March and April of 1970.

The analysis of the interaction matrices indicated several differences between the two groups. The results were summarized by Pacey as follows:

1. More information was provided directly by the teacher in IPI. Closer examination revealed that this tendency was general throughout the matrix. That is, IPI teachers tended to precede and follow student talk with their own thoughts and opinions more than did teachers in the control group. There was no other significant build-up elsewhere, for example, use of extended lecture was about the same in both groups. This indicated that rather than taking time to build on student ideas, IPI teachers tended to explain answers quickly and move on, which may suggest that the IPI system is rushing teachers.

2. IPI teachers made less use of questioning. The pattern for this is consistent with number one. These two differences would seem to be significant because the IPI system claims that teachers should avoid telling students answers, but rather should encourage them to discover answers for themselves, by leading them there via careful questioning.

3. There was substantial increase in student talk in the IPI group, especially student-initiated talk. This is certainly, at least in part, due to the system, in which students come to the teacher for assistance or guidance, usually at their own initiative. But careful analysis of teacher reaction to student talk indicated that the teachers in the IPI group seemed to encourage it.

4. Related to increased student talk was the dramatic increase in extended student talk. When a student began talking to the teacher, he was allowed to talk for sustained periods of time more frequently in the IPI group than in the Control group.

5. A significant increase was evident in the use of motivating and encouraging teacher behavior in the IPI group. Although use of these behaviors was not very extensive, it was higher than in the Control group. This, of course, may be due to differences between the schools, but it might also be

attributable in part to the IPI system, which allows one-to-one interaction on a far greater scale than normally.

6. There was a corresponding decrease in the use of controlling teacher behaviors in the IPI group. That is, IPI teachers tend to give directions and criticism less often than did the Control teachers. The IPI system would seem to account for the decrease in giving directions, since the materials do much of that. The decrease in criticism might be partly attributable to the system, which is success-oriented and gives students a fair amount of freedom.

7. There was less use of extended indirect teacher behavior in the IPI schools than in the Control schools. This may suggest once again that teachers do not have enough time to adequately develop and encourage student ideas and feelings.

Because IPI had only been in the schools for six or seven months at the time of the observations, the study was viewed as exploratory in nature.

Outcome Evaluation

The outcomes of the program were examined in two ways, comparatively, and judgmentally. Two general kinds of effects were investigated, achievement, and attitude. The attitude effects were investigated with students, teachers, and a sample of parents.

Comparative Study of Student Achievement

In an effort to evaluate student achievement in mathematics in a comparative way, two subjects of the Canadian Tests of Basic Skills (CTBS) were administered to the students in grades 3, 4, 5 and 6 in the IPI and Control schools. The CTBS is a version of the Iowa Tests of Basic Skills adapted for use in Canadian schools. The two subtests used in the evaluation were Arithmetic Concepts and Problem Solving. These tests were designed to reflect the skills and objectives pursued in most existing textbooks. The Arithmetic Skills test contains items measuring concepts involving currency, decimals, equations, fractions, geometry, measurement, numerals and number systems, percents, ratios, and whole numbers. The Problem Solving test includes problems that involve the kinds of operations and concepts that generally appear in the first half of textbooks for a particular grade.

The tests were administered in September and May of the first year of the program. At each grade level an analysis of covariance was carried out on both the Arithmetic Concepts and Problem Solving tests to see if there were significant differences in the May means after adjustments were made for differences that existed in September.

The results of the analysis for both tests showed no significant differences at grades 4 and 5. For grades 3 and 6, the adjusted mean for the Control group was significantly higher than that of the IPI group.

In all cases, the differences in adjusted averages, did not exceed 2.25 points. The individual school averages for the May testing were compared to the norms for school averages provided by the publishers of the test. These norms indicate the percentile points for grade averages when the tests are administered after April 1. For the six schools in the study, and four grade levels in the study, only two grades of the 24 were below the 50 percentile

on Arithmetic concepts, and only five grades were below the 50 percentile on Problem Solving. This record indicates that all of the schools seem to be doing a remarkable job (in relation to the schools used in the norming procedure) in preparing their students in areas measured by the CTBS. Thus, even though differences that exist favor the Control group, this should not be taken to mean that the results for the IPI group are poor.

In an effort to determine whether or not there were any differential effects of the program for different ability levels, the data were reanalysed with the students categorized into ability levels. The Lorge Thorndike Verbal and Non-Verbal Intelligence Scales were used separately to categorize the students into three broad intellectual groups. Because the test was administered at the same times as the CTBS, it was possible to place students into the three groups according to their September and May scores. Only data for students whose I.Q. scores fell within the same category on both administrations of the test were used in subsequent analyses. The categories were defined as I.Q. scores of 95 and below, 96-115, and above 115. Once the students had been classified by ability, students from each category were selected at random until there were equal numbers of students in each category defined by the IPI-Control dimension and the high, medium, low ability dimension.

In all analyses, the September score on the CTBS scale was used as a covariate in an attempt to partial out differences that existed among the groups on the September testing. In one way, the analysis is really an analysis of gains made over the year. In the analysis, it was expected that the higher ability levels would gain more than the lower ability levels so that one would expect a significant difference among the ability levels. Differences between the IPI and Control groups might also exist as had been noted in the previous analysis, although some inconsistencies with the previous analysis might exist because of the smaller number of students used in the present analysis. The critical test, and the purpose of the present analysis was the test for the interaction between program and ability level. Presence of a significant interaction might indicate the effects of the IPI and Control programs on one ability level were different from the effects at another level.

The results of the analysis showed significant differences among ability groups, as expected, and between IPI and Control groups at grades 3 and 6 as shown previously. There were no significant interactions between ability groups and program. Since no interactions were significant, there is no evidence to suggest that either program is more effective at one level than at another.

Of course, the success or failure of a program cannot rest on a single or even two measures of educational achievement. Because the IPI program is generally conceded to be an innovation in method and not content, the CTBS Scale used seemed appropriate measures for determining gross differences between the IPI and Control schools. However, future evaluation should include finer instruments in order to be able to document specific differences between the groups.

Where differences did occur, (at grades 3 and 6), the Control group showed superiority. This may be due to a number of factors, each of which

must be considered for future evaluation and decisions. While the schools' curricula did not differ greatly in content, the sequence of material may have been able to account for the differences that occurred. The IPI sequence may have put them at a disadvantage in grades 3 and 6, or, on the other hand, the Control schools may have been at a disadvantage in grades 4 and 5. Another factor that may have accounted for the results is that the students at the different grade levels were different for the two programs. The analysis of covariance in the study was used in an attempt to overcome differences in CTBS scores that existed prior to the implementation of the program, it cannot be expected to make the groups "equal" however. Differences in teachers and classroom atmosphere could also have contributed to the results. Finally, it is also possible that the IPI program itself is not as strong at grades 3 and 6 as it is at grades 4 and 5.

Measurement of Student Attitudes

As one method of collecting information about changes in student attitudes over the first year of the program, a Student Questionnaire was administered to the students in grades 3 to 6 of the IPI and Control schools in September and May, (Maguire, 1971).

In general, the results of the questionnaire indicated that the students in the IPI schools at all grades liked mathematics better than their counterparts in the Control schools. A second finding was that more students in the IPI schools found mathematics easy, than in the Control schools. Both of these findings occurred at September and May which leads one to believe that there are additional factors operating beyond the IPI program itself. However, since the September administration was made after the children had been in school for almost a month, the month's experience may have caused the difference.

In addition to collecting attitudes toward arithmetic activities an attempt was made to evaluate some generalized student attitudes toward their environment. In May, a "pupil opinionnaire" developed by the staff at Research for Better Schools Inc. for use in their evaluation of student attitudes toward IPI was administered. This opinionnaire used a semantic differential format. Students were asked to rate eight concepts on 9 five point scales. The eight concepts were:

My School Is
Being Praised for Doing Something Well is
My Classmates Are
Working by Myself in School is
My Math Class is
Being Scolded for No Reason is
I am
Taking a Math Test is

The nine scales used were:

smart—stupid
happy—sad
easy—hard

fair—unfair
 bad—good
 slow—fast
 nice—awful
 useful—useless
 boring—interesting

The instrument was administered to all students in grades 3, 4, 5 and 6. The responses were made anonymously. Because the instrument was being used on a speculative basis, the students were not required to indicate their grade level. As a result there were 497 responses in the IPI group and 542 responses in the Control group.

The differences between the average ratings of the IPI and Control groups were tested for each concept on each scale. In all there were 72 tests carried out.

For the concepts “Being praised for Doing Something Nice”, “Being Scolded for no Reason”, and “I am”, there were no significant differences on any of the scales. For the “My Classmates are” concept, the IPI group rated their classmates closer to the smart, fast, and good ends of those scales than the Control group. All other scales were not significant.

The “My School” concept showed significant differences on all scales except hard-easy. The “My Math Class” concept showed significant differences on all scales except useful-useless, where the average rating for both groups was next to the useful end of the scale. “Working by Myself in School” was significant on all scales except hard-easy and fast-slow. On all of the scales on which significance occurred, the IPI group means were closer to the smart, fair, interesting, nice, good, happy, easy, fast, useful ends of the scales than were the Control means. In all of these cases too the Control group was closer to the above ends of the scales than they were to the other end.

For “Taking a Math Test”, the IPI group rated it closer to the nice, interesting and happy ends of those scales. There were no significant differences on the other scales.

The interesting findings is that despite the extremely powerful test used (the degrees of freedom were over 1,000) not all of the tests produced significant results. In tests that involved general concepts such as “Being Praised . . .” and “Being Scolded . . .” no significant results occurred. These results suggest that the scale may have some validity and that the IPI children are not trying to produce results that merely please. The self concept scale, “I am”, also showed no significant scales. The “Classmates” concept only showed three significant scales. In general, the concepts involving school experiences that were different for the two groups did produce significant results with the IPI group exhibiting some positive responses. Of course, one must note that the Control group responses were not negative. In most cases they were only slightly less positive.

As a result of the two questionnaires, it seemed fair to conclude that the IPI program as installed in the three schools of the study tended to produce a greater enthusiasm for arithmetic among the students than the Control program did for its students. This enthusiasm does not appear to be blind. On questions that do not reflect program characteristics, there appear to be few differences between the groups.

It is difficult to separate attitudes towards mathematics from attitudes towards the mathematics environment. We cannot conclude that IPI caused student enthusiasm. It may have been skillful teachers who produced this result and they may have done so using any innovative program. In future evaluation activities it will be useful to interview students so that the questions can be explored.

Comparative Study of Teacher Attitudes

In order to tap the general feelings that teachers in the IPI and Control schools have toward a number of Educational topics, an attitude instrument was constructed using the semantic differential format. Two kinds of topics were covered. The first set of topics: Innovation, Mathematics Education, and Individualized Instruction, were chosen because of their direct relevant to the project. The second set: Students, Teachers, Parents, and School System were included in an effort to obtain some measure of the general level of morale among the teachers.

The teachers in both groups were asked to rate the topics on the 29 adjective scales shown below. The instrument was administered in October and May.

Exciting—Dull	Systematic—Chaotic
Temporary—Lasting	Extravagant—Necessary
Authoritarian—Democratic	Worthwhile—Futile
Society oriented—Individual oriented	Ineffective—Effective
Traditional—Modern	Reflective—Impulsive
Difficult—Easy	Isolated—Integrative
Practical—Theoretical	Stationary—Moving
Enjoyable—Boring	Peripheral—Basic
Important—Useless	Inexpensive—Expensive
Concrete—Abstract	Frustrating—Satisfying
Good—Bad	Positive—Negative
Weak—Strong	Inadequate—Adequate
Precise—Vague	Not time consuming—Time consuming
Divergent—Convergent	Active—Passive

Two way analyses of variance were carried out on the judgements of each concept on each scale. The independent variables used were IPI versus Control group and October versus May testing. In all, 203 such analyses were carried out. Since there may be some very high correlations among scales, it is very likely that many of the results that are judged to be significant could have occurred by chance (even if the scales were independent, one would expect 5% of them to be significant.) Nevertheless, for the sake of simplicity of presentation and interpretation, the two way analyses were carried out. Most of the teachers responded anonymously, so that it was not possible to analyse the results properly, that is by taking into consideration the correlation between pre and post tests.

In considering the results, it is useful to keep in mind the rationale for carrying out the test. If participation in the IPI program (or factors concurrent with it such as Hawthorne effect) produced changes in teachers' attitudes that were different from changes that occurred in the Control group then a significant interaction should result. If there were a general change in attitude for both groups, then a pre-post test (Time) effect would be significant. If

the groups differed in attitude prior to introduction to the program, and this difference persisted throughout the program, then a significant Program effect would be noted.

In almost all cases, it was clear that even though one group rated "Innovation" for example, as being duller than the other group rated it, the average values for both groups fell on the exciting side of the scale. Thus such a result cannot be interpreted as one group's thinking that Innovation is dull and the other thinking that it is exciting, rather it is an indication that one group sees innovation as being more exciting than the other.

The results showed that only two interactions occurred. This seems to indicate that any differences between the groups may have existed prior to the first testing occasion.

Part of the result that the teachers' attitudes were different prior to the first testing occasion may have arisen from the intensive training program that was conducted. At a week-long course in IPI methodology that was held in Baff in August 1969 much enthusiasm was generated among the teachers for the program. The attitude scale was administered in late September and early October.

A second confounding factor was the degree of attention that was paid by the Control group to the scale. The Control group received no benefit from their participation in the program. In general the teacher attitude scales were administered after the Control group had been subjected to a batch of other tests in their classrooms and while the cooperation was good, one could not help but feel that the attitude scale was seen as an unnecessary imposition on the teachers' time. No indication of any attitude toward the questionnaire was received from the IPI group.

If one looks at the concepts individually, a picture of the teacher's attitudes begins to form. For the concept Individualization, the IPI teachers tended to see it as more exciting, lasting, democratic, individual oriented, modern, practical, enjoyable, important, good, strong, precise, integrative, moving, satisfying, worthwhile, effective, reflective, positive, adequate and active than the Control group. Again the responses indicate that the IPI teachers are generally enthusiastic about the program. It is interesting to note there were no differences on the time scale. This is one of the situations where both groups saw individualization as very time consuming. Similarly on the difficult-easy scale, both groups placed Individualization at the difficult end.

The Parents' concept showed significant differences on 17 scales, with the IPI teachers seeing parents as more exciting, lasting, democratic, easy, practical, theoretical, enjoyable, important, good, integrative, inexpensive, satisfying, worthwhile, effective, positive, adequate, not time consuming, and active than the Control group. The responses to this concept illustrate one of the problems with this technique. Often seemingly inappropriate scales such as temporary-lasting show differences among groups. With interviews, the reasons for the responses can be explored; with questionnaires, the reasons are left to the imagination of the interpreter. Two kinds of interaction with the parents were different for the two groups. Parent interviews were used in place of report cards for the IPI group, and parent volunteers were used to aid the teachers in the classroom.

For some of the scales it may have been this increased contact with parents that produced the results. In particular the responses to the scales such as enjoyable, satisfying and worthwhile might reflect this. On scales such as lasting and inexpensive, the IPI group may be referring to the effect that parents were having on the IPI program as a result of their volunteer activities.

Sixteen scales were significant for the concept Students. The IPI teachers rated this concept as more exciting, lasting, democratic, individual oriented, modern, practical, enjoyable, important, strong, precise, moving, satisfying, systematic, worthwhile, positive and adequate. Again, it is difficult to separate generalized reactions to students from reactions to students within the context of IPI. It seems safest to suggest that all of the teachers seem to have a high regard for students with IPI teachers giving slightly higher ratings on some dimensions. This may have resulted from more contacts with students on a one-to-one basis since the IPI system requires teacher-pupil conferences. Whether or not the actual time spent with individual students is greater in the IPI system has yet to be established.

IPI teachers rated Teaching as more exciting, lasting, democratic, individual oriented, modern, enjoyable, important, integrative, moving, effective, positive, adequate and active than did their Control counterparts. Both groups saw teaching as being practical, good, strong, complex, expensive, satisfying, systematic, necessary, worthwhile, and time consuming. It would seem that the teachers in both groups must be described as dedicated to their vocation. Large differences existed on two scales: democratic and individual oriented. These scales may reflect attitudes that are program specific.

Mathematics Education produced only nine significant scales. IPI teachers rated the concept as more exciting, democratic, individual oriented, integrative, moving, expensive, effective, and active. Many of these scales seem fairly closely related to the program. The attitudes toward Mathematics Education in a broad sense seem fairly similar.

The School System, the concept furthest from the IPI program, showed significance on six scales. The IPI teachers rated it more democratic, important, necessary, worthwhile, reflective and adequate. Perhaps, six scales represent a sort of chance level. None of these scales seems particularly important. In general, teachers' reactions to the School System seem to vary from neutral to fairly positive. One would not expect many differences here as the School System is quite remote from individual teachers.

Given the conditions under which the instrument was administered; that is after the program had been in operation for a month, one can see that it would be difficult to show the significant interactions suggested earlier. It does appear that the enthusiasm toward the program has not flagged over the year between administrations. In looking in general terms over the concepts and scales it seems fair to conclude that the IPI teachers have responded enthusiastically to the research that has been conducted in their schools. Much of this effect is likely due to either the novelty of the situation, or the special treatment given

to the schools, however, collection of similar data in subsequent years when the novelty effect has gone will indicate long term differences that exist in attitudes.

Teacher Interviews

Conners (1971) interviewed the 33 teachers who had worked with IPI for eight months in an effort to determine their opinions about the program. Six question areas were explored.

Question One: What perceptions do teachers have of IPI mathematics as an instructional package?

The study revealed that most teachers were extremely satisfied with IPI mathematics as an instructional package. The objectives of the program, the materials used, as well as the structure and flexibility of the program were considered as good, if not superior to most programs. However, more definite advantage were claimed for IPI over most other programs. In the opinion of the majority of teachers, IPI mathematics provides better for the "above average" and "average" pupils than most mathematics programs because it does not inhibit the pupils' progress. IPI also, through its variety of instructional approaches, appears to provide well for the different learning styles of pupils and allows pupils to work at their own pace. It must also be noted that after contact with IPI, all teachers in this study indicated their desire to individualize instruction in most other subject areas.

While IPI appears to have many "strengths," there appear to be some "weaknesses" in the program. The data suggest that IPI does not free the teacher from teaching the routine, basic skills of mathematics. It appears that efforts on the part of the teacher have now been transferred from a large group situation to an individual basis. The data also suggest that IPI, because of the structure and the pressures of the system, does not provide "well" for the student who wishes to pursue some special interests in mathematics.

Question Two: What perceptions do teachers have of the role of the teacher in the IPI system?

The data suggested that in the IPI system the teacher's role is changed from the traditional concept. The teacher lectures far less, works harder and has more demands made upon him in knowing the subject matter and curriculum. However, it appears that there is greater satisfaction working in an IPI classroom when compared to a conventional classroom because the individual contact with students allows the teacher more opportunity to assist the individual pupil than was previously possible in a conventional classroom. This satisfaction is enhanced because of the immediate feedback concerning the student's progress. The data also indicated that teachers in the IPI situation find their role to be more challenging, modern and professional than in a conventional classroom. It appears that IPI presents an opportunity for the teacher to work effectively with each individual in the classroom. The teacher is given an opportunity to become more "professional" as she becomes a "diagnostician" of learning, a decision maker and a guide for the pupil rather

than a “fund of knowledge.” It appears therefore, that IPI creates greater opportunities for the teacher to use all her science and art as a teacher, in order to assist the individual pupil.

The data also suggest that contrary to some opinions, the IPI teachers do not find working in the IPI situation to be a “dehumanizing” experience for themselves or the pupils. In fact, it is suggested that IPI assists teaching and learning to become a more “humanizing” experience for both teachers and pupils because the teachers come to know and understand the students better as individuals.

Question Three: What perceptions do teachers have of pupil reactions to the IPI program?

Analysis of the teachers’ perceptions indicated that most pupils react very favourably to IPI mathematics and prefer working in the IPI system to working in a conventional program. It appears that when pupils have been exposed to an individualized program of studies, then the majority do not wish to return to a “whole class” approach. It also appears that involvement in the IPI system fosters pupil initiative, self-confidence and responsibility, and that behavior problems decrease. Pupil motivation is extremely high in IPI, and in the opinions of teachers, more mathematics is covered than in a conventional program.

Question Four: What perceptions do teachers have of the role of the aide in the IPI program?

The study revealed that IPI could not operate effectively without the assistance of teacher aides. It appears that the aides are essential for marking and other clerical duties so that the teacher can devote her time to helping individual pupils. The data also indicate that the aides have become an accepted and integral part of the schools involved in the IPI project.

Question Five: What perceptions do teachers have of the ways in which IPI has influenced the organization, administration and functioning of the school?

The results indicated that teachers appreciate the opportunity given them to individualize instruction, that they do not wish to return to the “traditional” methods of instruction and that IPI has a positive influence upon their educational philosophies. It is also suggested that IPI need not interfere with the general administration of the school and that it can influence the behavior of the administrators by bringing them into the classroom more than normally. Administrators, because of this contact, are in a position to “get to know the pupils better.”

Question Six: What perceptions do teachers have of the manner in which IPI has affected the school system and the parental community?

The study suggested several extremely advantageous aspects of IPI are related to the parental community. It appears that IPI can assist in the improvement of communication with the parental community because the use of volunteer (parent) aides can bridge the gap between school and community, and because pupil enthusiasm for the program is transmitted to the parents. Secondly, involvement of parent aides can engender more

parental support from the community. Thirdly, the detailed IPI records give teachers a more concrete basis to discuss a pupil's progress with his parents.

In addition to the major questions, four subquestions were explored.

Sub-Question One: Do teachers in schools situated in an urban, higher socio-economic area; an urban, lower socio-economic area; and a rural area, have different perceptions of the IPI program in mathematics?

The study revealed that there were no major differences between the perceptions of the teachers in the three schools, (one rural, one in an urban, higher socio-economic area and one in an urban, lower socio-economic area). However, the data do reveal some minor differences. They suggest that pupil peer rivalry is more likely to increase in an urban school, and especially in one situated in a higher socio-economic area. Teachers from the rural school were also more prone than teachers from the two urban schools to consider that their role had become more professional, while teachers in the urban schools considered their role as a teacher had become more modern. The only school that perceived IPI provided well for the "below average" pupil was the school in the urban, lower socio-economic area.

Sub-Question Two: Do teachers with different teacher training backgrounds have varying perceptions of the IPI program?

The results indicated that the professional training a teacher has received does not appear to influence her performance in IPI or her perceptions of the majority of the aspects of the program. It is, however, suggested that the more highly trained a teacher is, the more conscious she becomes of the need for adequate conferences and planning sessions, and the more training a teacher has, the less likely she is to expect assistance from the teacher aides.

Sub-Question Three: Do teachers with varying years of teaching experience have different perceptions of the IPI program?

The study revealed that the less experienced teachers were more likely to request and need additional inservice conferences, planning and training sessions. The less experienced teachers considered that their role had become more modern since the introduction of IPI, while the more experienced teachers perceived that the assistance of aides had helped to positively change their attitude toward teaching.

Sub-Question Four: Do teachers' perceptions of the IPI program vary according to the grade or class taught?

The study revealed that pupil attitudes and behavior were more likely to change in the upper elementary grades than the primary grades after contact with IPI. It is also suggested that teachers of the upper elementary grades are not as prone as teachers of the primary grades to involve teacher aides in actual "professional" work, and that they are more likely to favour individualization in "all" subjects. The data also revealed that IPI provides well for the "below average" student in the upper elementary grades, while it appears to provide "unsatisfactorily" for the "below average" student in the primary grades.

In summary, Conners' study (1971) showed that the teachers were generally pleased with the success of the application of IPI, but had a number of important suggestions for future development.

Parental Opinions of IPI

As a final component in the evaluation, Hoke (1971) interviewed a random sample of 35 parents who had children in the IPI program. Three kinds of opinions were solicited: opinions of the program as administered in the school, effect of the program on children, and opinions of personal communication and administration details connected with the program.

A number of questions were asked of the parents concerning their thoughts about the IPI program itself. In response to a question asking about the desirable features of the program, the five most common responses were:

1. Children can work at their own speed.
2. Teacher aides were hired.
3. There were benefits using parent volunteers.
4. There were benefits in parent teacher conferences.
5. Instruction was individualized which developed the child's own scholastic and personality strengths.

When asked for the least desirable features of the program, the five most common responses were:

1. The slow unaggressive or lazy child was not pushed and given enough teacher supervision.
2. Parents, unable to volunteer were not involved and were frequently not informed about the arithmetic concepts completed by their children.
3. Children did not take arithmetic homework.
4. The desk work of the teacher prevented her from circulating around the class to teach, encourage, or supervise.
5. The IPI student profile sheet had little meaning for comparative purposes.

In response to questions concerning specific facts of the program, most parents were in favor of the children working at their own speed, but only about half of the parents were pleased with the lack of homework in IPI.

When responding to questions concerning the effect that the program was having on the children, about half of the parents thought that their child was achieving more than in the previous year, whereas only ten percent thought that the child was achieving less. Eighty percent of the parents were satisfied with the achievement. In response to questions concerning the effects of IPI on the children's future progress, some parents expressed concern with the lack of continuity between elementary and junior high school, however most of the parents indicated that experience with IPI would have a beneficial effect on the child's attitudes toward school in future years.

The final set of questions referred to the opinions of the personnel, communication and administrative variables connected with IPI. Most of

the parents were in favor of hiring teacher aides. They were also in favor of the use of parent volunteers in the classroom, although none of the parents interviewed was a volunteer. The child's progress was reported to the parents by means of an interview. Most parents liked these regularly scheduled conferences but a few criticisms were voiced: more interviews were needed; teachers can frighten parents if the parent does not have much self confidence; because the child is not at the interview, he cannot benefit from the feedback directly.

In response to a question asking whether or not the parents saw IPI as being worth the extra cost that was required, over 80 percent of the parents answered yes. Over 50 percent of the parents said that they would be in favor of an increase in taxes for improving educational standards using programs like IPI.

IPI arithmetic was valued for the effect it had of creating enthusiasm and motivating their children so that school became more interesting or likeable. Because of this, parents felt IPI was a superior instructional method, and was an improvement over the textbook approach. Several people felt the IPI method made the child's mind more alert and resulted in the learner being able to think more clearly. The concept of mastering materials was valued because parents felt that slow, medium, and fast working children would become more skilled in arithmetic. It was felt most children were benefitting from individualization of instruction; none were being held back or being forced to catch up with the class.

In general, there were a number of conditions which made the IPI project acceptable to the respondents. In the parents' estimation, the three experimental plants were excellent schools; parental communications with the school had been adequate during the first year of the study and also during the preceding year; the parents expressed respect for the qualifications, competency, and personalities of the school personnel; they were pleased with the quality of instruction in all subjects; and the parents felt that the various methods of reporting child progress complemented one another.

There were indications from parents that the IPI arithmetic program should have some restrictions placed on its implementation. Every parent interviewed, who had a first year (grade one) student working with the IPI materials, questioned the value of the instructional method for these students.

Summary and Discussion

In attempting to tie together the results of the evaluation, one becomes concerned that the particular schools chosen for the study may not be typical of the elementary schools in Alberta. To some extent this must be true. The IPI schools were chosen because of their willingness to innovate. The bases for nominating the Control schools were: the social class of the community served, size of staff, number of students, and similarity of physical facilities. It became apparent that the Control schools also possessed many of the same forward looking philosophies as the IPI schools.

In discussing the results it must be remembered that the participating teachers became very enthusiastic about the program and it is difficult to separate the effects of the program from the effects of the teacher enthusiasm. The results may generalize to other situations where IPI is used. We report what *can* happen not what will happen.

In capsule form, six conclusions can be highlighted from the research evidence.

1. IPI students did not achieve more than the Control students. In fact, where differences did occur, they favored the Control students. The achievement measures used, CTBS Arithmetic Skills and Problem Solving Subtests, are generally accepted as being among the most useful of the standardized tests of arithmetic achievement. Since they were designed to measure fairly traditional objectives, they were considered as appropriate in the present study.

2. The IPI students had a more positive attitude towards arithmetic than the Control students. The main difference between the two programs (other than the teacher variable) is that the children proceed at their own speed in the IPI program. As a result, there may be fewer frustrations. The sequence of material is about the same, in the two programs, so that time and the ability to work to a certain extent under conditions of their own making may be the important variables for student satisfaction.

3. The IPI teachers were more positively disposed towards innovation and individualization than their colleagues in the Control group. It seems unlikely that IPI *per se* had much to do with this finding. It is more likely that two situations acting in opposite directions combined to produce the result. Participation in an innovation—particularly one as highly structured as IPI—can easily produce a positive attitude toward the project. On the other hand, being asked to act in a Control group with no short term payoff can easily have the reverse effect on the Control teachers. These two factors in combination may account for the difference between the two groups. In any event, as a result of participating in the project, the teachers seem to have developed an openness to innovation. This openness coupled with the experience with a fairly successful program suggests that a pool of teachers now exists with whom curriculum development projects might be undertaken.

4. The IPI classroom allowed for more extended student interaction with teachers than did the Control schools. Often, one of the charges made against individualized programs is that they overlook the important social component of education. The results of this evaluation suggest that the reverse might be true. Extended teacher-student interactions are those interactions in which the student is allowed to talk to the teacher for sustained periods. This being the case, the results suggest that IPI students have longer conversations on an individual basis with their teachers than Control students do. A second interesting result of the interaction analysis was that IPI teachers used fewer controlling and criticising statements than their Control counterparts.

5. Parents of children in the IPI program were favorably impressed with the program and more than half of the parents would favor an increase in taxes to support the program. It is difficult to say if the parents' behavior would be consistent with their statements, nevertheless, their acceptance for all facets of the program was impressive. Many parents noted that changes had occurred in their children's attitudes towards arithmetic, and seemed to place a good deal of importance on this observation.

6. The parents freely gave their time to help in the many clerical chores that form part of the program. It is very difficult to say how the cooperation would be over an extended period of time. Clearly, the parents saw the program as experimental. It may be that as a program such as IPI became institutionalized, the parents would expect the boards to take over the responsibilities for clerical chores.

In discussing the results and attempting to reach some overall evaluation of the project, a number of factors must be weighed against each other, and to some extent each reader must pass judgment according to his own value system. The IPI program did not produce higher achievement on measures of educational objectives that are generally valued by society. The cost of the IPI program is greater than that of the standard elementary school arithmetic program. These two factors would suggest that the IPI program does not produce compensating benefits for higher costs. But the IPI program (and the teachers) do bring about more positive attitudes towards mathematics. How does this benefit stack up to the cost? Many parents felt that the results were worth more than the cost; however, one of the truths of educational research is that enthusiasm is an unstable commodity. Will the same results persist if the program is carried-on or instituted on a wider scale? Will parents continue to volunteer their services as the program becomes common place? Will achievement in the IPI schools actually fall behind that of the Control group as teacher enthusiasm is focused on other matters? Will achievement in the IPI schools become superior as teachers and students become more familiar with individualization? These are some of the questions that must be answered before decisions for adoption are taken.

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Erwin Miklos

Reflections

The invitation to select an article for the 40th Anniversary issue of *AJER* did give me reason to pause and to reflect. My term as editor began with the production of the last issue of Volume 16. Consequently, the term falls well within the first half of *AJER*'s history.

My primary concern as editor related to ensuring the survival of *AJER* both financially and in terms of publishing quality articles. Although publication of the journal was supported in various ways by the Faculty of Education, the printing and distribution costs had to be covered by revenue from subscriptions and grants. In the early 1970s, production and distribution costs were increasing while grant and subscription revenue remained fairly steady. The problem of funding production on an issue-by-issue basis and using subscription revenue for future issues to cover current production was alleviated by the success with an application for a Canada Council publication grant in 1972. The grant greatly reduced the financial uncertainty at the time, and subsequent Canada Council and Social Science and Humanities Research Council support has continued to help keep *AJER* viable.

The awarding of a Canada Council grant, which involved a thorough external review process, also served to confirm that *AJER* had established a national reputation as an educational research journal.

With respect to maintaining and enhancing the quality of articles, I had hoped for but did not experience any dramatic increase in numbers of submissions. However, there continued to be an adequate supply from local, national, and international sources. I was impressed by the willingness of authors to revise manuscripts in accordance with suggestions of reviewers. Accordingly, I attempted to maintain the quality of manuscripts, in spite of a relatively low rejection rate, by providing a fair measure of advice to contributors for improving their manuscripts. I would like to believe that this service was especially important for the graduate students and researchers early in their careers who comprised a relatively high proportion of the contributors.

Although the cover design is not a highly significant aspect of a journal, I am pleased that the one introduced in March of 1970 has met with the approval of a succession of editors for the past 24 years. I hope that by mentioning this I am not raising any thoughts that the time has come to change the design of *AJER*'s cover!

John McLeish

Editor, September 1972-June 1974

Native Education in the 1970s

Having been invited to select the outstanding article I chose to publish during my tenure of the post, I am in some difficulty not only because of the lapse of time but my failures of memory. It would be very easy to choose the worst, but I will leave readers to do that themselves. The problem is there are at least 10 articles that, on rereading Journal issues for these years, compete for the honor of being the best. Reflecting on my own experience of research articles in journals (as author, not as editor), I would single out A. Berger's piece on "The Education of Canadian Indians." This is subtitled "An In-Depth Study of Nine Families" (as it is, the reality counting for two merit points).

Without bafflegab, Berger points to the problem, hardly realized in the 1970s, that the dropout rate of Indian children in Canada was 94%, whereas with children in white schools it was only 12%. Noting that the situation was similar in the United States, Berger quotes Robert Kennedy (USA) as saying that this represents not only an national tragedy, but a national disgrace. This is all introductory matter, and excellent.

But the method, procedures, and data—not the opinions expressed—are the features defining quality research. Here these are specially commended. Nine families consisting of the fathers, mothers, and 40 children were interviewed as families on the Hobbema reserve near Edmonton. Four interviews, the first in English, the other three in the Cree language, were conducted by Georgina Trippe-de-Roche. No tapes were made of the family interviews, but the two interviewers wrote their recollections of what was said, these to be given to the family for use in the final exercise. The length of interviews was between one and seven hours. The attitudes of personal interest and concern expressed by the two interviewers easily won the involvement of the Indian families (the main impediment to such research). The authenticity of the study seized hold of the families involved to gain their cooperation. This is the major and outstanding feature of this study—its authentic flavor.

The finest part, however, nourishing this pervasive quality, were the procedures evaluating the statements made by the families. The first three interviews were broken down by content analysis into very brief single statements, which were typed on cards. These were presented to the families on the reserves with instructions to sort the cards into subject areas. The families selected between six and 39 such categories (e.g., cultural and tribal concerns, family, personal, religious, etc.). They were then asked to sort the cards into two piles: statements of immediate concern and those of less interest. The three most important, of immediate concern, were given as education, Indian heritage and culture, and family concerns. The fact is these Indian parents and children were very concerned about deficiencies in the administration and provision of education that

account for most of the Indian dropout. This article gave advance notice of Canadian Indian reactions of which we have become increasingly aware.

A. B E R G E R

The University of Alberta

The Education of Canadian Indians: An In-Depth Study of Nine Families

Education, heritage and culture are highly prized by families involved in this in-depth study of Canadian Indians. The study incorporates a number of relatively unique features; these include interviewing without using tape recorders, analyzing the data by means of content analysis procedures, involving the families in organizing the data, and writing the final report in the first person. Findings and conclusions contain implications for education and society. (Dr. Berger is Professor of Elementary Education, Faculty of Education, The University of Alberta.)

In Canada, the national dropout rate of Indian students between grades one and twelve is 94 percent; for non-Indian students, it is approximately 12 percent (Hawthorn, 1966). In the United States (U.S. Congress, 1968):

Dropout rates are twice the national average; the level of formal education is half the national average; achievement levels are far below those of their white counterparts; and the Indian child falls progressively further behind the longer he stays in school.

In citing these and other statistics at the Hearings before the Special Subcommittee on Indian Education, the late U.S. Senator Robert F. Kennedy observed:

These facts are the cold statistics which illuminate a national tragedy and a national disgrace. They demonstrate that the "first American" is in fact the last American in terms of employment, education, a decent income and the chance for a full and rewarding life (*Ibid.* p. 5.).

It is indeed unfortunate for Indians, as well as for the social and economic fabric of two great nations, that greater strides have not been taken to deal with this problem.

What are some reasons for the high dropout rate among Indian children? Can't they learn as well as white children? Don't Indian parents care about education? To find some useful answers, an interdisciplinary, in-depth study involving 40 children and nine families was conducted during the last half of 1971 and the greater portion of 1972.

The two-part study involved children in grades three and four in the Ermineskin School on the Hobbema Reserve. The permission of the reserve's Four Band Council was first obtained. Following a battery of individually-administered tests designed to assess the cognitive strengths of the children, an intervention program was developed on the basis of the test results. This produced significant gains in reading achievement in comparison with a control group of children. The children were using "simultaneous strategies" to solve problems requiring the use of "sequential strategies" (like reading), and *vice versa*; after the intervention program, their test scores increased dramatically.

The part of the study involving the families took place in or near their homes. Five of the families live in the City of Edmonton, one family about five miles west of the city on the Winterburn Reserve, and three about 50 miles south on the Hobbema Reserve. Each family was visited on four occasions. The conversations, which ranged from one to seven hours for each visit, were conducted either in Cree or English.

Before inviting these families to participate, discussions were held with representatives of the Indian Association of Alberta to determine the variables to be considered. The families were then studied with the following variables in mind: whether treaty or non-treaty; Indian or Métis; age of the children; mixed marriage or otherwise; varying levels of income.

The work with the families incorporated a number of relatively unique features. These included interviewing without using tape recorders; analyzing the data by means of content analysis procedures; involving the families in organizing the data; and writing a significant portion of the final report in the first person.

What follows here relates only to the design and rationale, analysis, selected findings and conclusions arising from the work with the nine families.

Design and Rationale

The general design of the study arose naturally from the question:

What are some of the views and feelings of Indian parents in regard to education, culture, and related matters?

In attempting to answer this question, each family was visited on four separate occasions in or near their home. Information was collected during the first three visits and organized during the final visit.

With nearly every family, except where transportation facilities were not readily available the following pattern of visitations was followed:

<i>Visits</i>	<i>Visitors</i>	<i>Language Used</i>
First	Berger	English
Second	Berger and Trippe-de-Roche	English and Cree
Third	Trippe-de-Roche	English and Cree
Fourth	Berger and Trippe-de-Roche	English and Cree

Each visit lasted from one to seven hours. An attempt was made not to interrupt the ongoing lives of the families. On the first visit the families were informed that immediately following the interview, the recol-

lections would be recorded, transcribed, and returned to them, in written form, for them to organize on the final visit. To determine the accuracy of the interviewers' recollections, the following reliability exercise was conducted at the start of the study.

There was a conversation with two Indians not connected with the families. This was recorded. Immediately following this conversation interviewers' recollections of it were recorded onto another tape. Both tapes were then transcribed and the transcriptions were given to three independent observers to assess the quality of the *recollected* conversations against the criterion of the actual conversation as recorded. The results of the assessment made by these independent observers indicated a high reliability for this technique.

The conversations, or "interviews," were conducted in a manner suggested by Lewis Dexter (1970) in his book, *Elite and Specialized Interviewing*, and by Alfred Benjamin (1968) who, in *The Helping Interview*, writes:

I do not see the interviewer as passive in the least. On the contrary, I see him as active at all times. I am not implying that he should talk a great deal, but I am saying that he should make his presence and interest continuously felt. The interviewer is active in gaining as deep an understanding as possible of the interviewee's world. . . . At all times he is active in revealing himself to be a person deeply involved in another person.

A rationale for in-depth studies is provided by David Fox (1969) in *The Research Process in Education*.

There are mass surveys as to the sociopsychological characteristics of children who ultimately become anti-social as to be legally classified as juvenile delinquents. We know that most often they come from broken homes, that, except for sex offenses, they are more likely to be boys than girls, that their social malfunctioning is accompanied, and usually preceded, by academic malfunctioning, and so on. Yet we still have not learned from this mass survey approach how the different deprivations and difficulties interact so that some children become serious delinquents and others, who exhibit the same characteristics identified by the mass survey, do not. The answer lies in other characteristics yet to be identified, and/or in the pattern of interaction of the characteristics in the individual. It is at this level that the case study approach would function, studying the characteristics as they exist in company with each other within the person and life space of individuals.

Further rationale can be found in the preamble to *Let Us Now Praise Famous Men* (Agee and Evans, 1941) and in the Introduction to *La Vida* (Lewis, 1966).

Content Analysis

On the fourth visit each family engaged in a series of intriguing sorting processes to organize the data obtained during the first three visits. The information obtained during the conversations with each family had been previously subjected to content analysis. The typed recollections were scrutinized to cull each meaningful unit of expression (e.g., Harold Cardinal is a great man). Each of these units was typed on a 3 x 5 card; each family had up to 75 cards. On the fourth visit, then, the family placed each of their own cards into categories of their own creation. That is, they looked at a card, said it was "religion" (for example): the

card was then placed in an envelope on which the word “religion” was written. At the end, some envelopes contained many more cards than did other envelopes; some families had many more envelopes, representing categories, than other families.

The families were engaged in a final sorting process. They took the envelopes bearing the categories and made two piles, one containing items of immediate interest and concern, and the other containing items of lesser interest and concern to them.

With the permission of the families involved, the cards that had been made into the fewest number of categories (six) were exchanged with the cards that had been made into the largest number of categories (39). The intent was to see how many categories each family would make with the other family’s data. Family D made 39 categories with their own data and 37 with Family C’s data; Family C made six categories with their own data and 10 categories with Family D’s data. This result was expected,

TABLE 1
TOPICS OF IMMEDIATE INTEREST AND CONCERN TO THE FAMILIES

Common Categories	Families									Totals	
	A	B	C	D	E	F	G	H	I	**	*
Education	**	**	**	*	**		**	**	**	7	1
Heritage and Culture	**	**	**	**	**		**	**	**	8	
Family	*		**	**	**		**		**	5	1
Indian Organizations	**		**	*					*	2	2
Discrimination	*	**	**	*					*	2	3
Integration			**	**	*			*	**	3	2
Employment	**	*		*	*			*	**	2	4
Treaty Rights	**	**		*	*					2	2
Personal Concerns	*			*				**	**	2	2
Language		**					**		**	3	
Religion	*			*	*		**			1	3
Social Status				*				*	**	1	2
History	*			**						1	1
Communication	*						**			1	1

** Indicates "of immediate interest and concern"
* Indicates "of lesser interest and concern"

¹Family F did not continue beyond the first conversation for reasons of a personal nature.

²Extrapolated from cards and categories made by Family I.

the assumption being that the processing of information is not largely affected by whose information is being processed.

The two interviewers scrutinized the typed recollections to see what was actually discussed during the conversational visits. This was for the purpose of determining whether the families chose to discuss certain topics with the Indian visitor and other topics with the white visitor. Two people also (independently) examined all of the cards in all of the envelopes to form common categories.

Selected Findings

The upshot of the organized data appears in the table showing common categories of immediate interest and concern to the families. Of most immediate interest and concern for most families are education, heritage and culture, and family.

Conclusions

As might be expected a great number of surprising insights were achieved as a result of these visits and conversations. Indians, as other people do, express concern with many of the same problems with which we are concerned. Contrary to the stereotype of the Indian being unconcerned about education, the families in this study talked more about this than about any other topic. They saw education as the way to a better life for their children, and desperately wanted them to succeed in school. One family was distressed about their son who had dropped out of school. The only family that indicated "education" to be of "lesser interest and concern" was one where all the children were grown-up and employed.

In conversations with the families and others, it also appeared that Indian people have special problems that directly affect their education. The boy who dropped out of school is illustrative of the many Indian boys who must leave the reserve after grade nine if they want to continue their education. The fact is that most reserve schools do not go beyond grade nine; many do not go beyond grade six. What this means is that these young people must leave their families and go off by themselves, live in a room in the city, and continue their education. It is a trying experience for those who are unprepared for city life. They may be told which buses to take to get to their school, and how to return, but it is often overlooked that it is also vital information for reservation-reared children to know about how to get on and off the bus, or how to transfer to another bus. Some of the families indicated that their children had found a room with old couples who needed the income but who also needed a degree of quiet that few normal teenagers are able to provide. Such problems often arise in regard to the homes in which these youngsters are placed. Often overlooked, also, is the fact that many Indians are very poor, sometimes owning only one pair of clothes. As a result, some children who go to school in cities or smaller communities have to miss school on wash day.

Many Indian people know these problems, but are not in a position to influence changes. This is because they have very little control over their own education. In the Province of Alberta, which provides some of the best education on this continent thanks to the province's wealth

from oil and natural gas resources, it is not legally possible for Indians to sit on Boards of Education. This is information given by a spokesman for the Department of Indian Affairs.

While most reserves have school committees, many are largely ineffective, with Indians having little or no say about who should teach their children. As a result, one Indian family living on the Hobbema Reserve within sight of Ermineskin School sends their children to school in a nearby "white" community because, the husband explained, many of the children cannot understand some of the foreign-born teachers who speak broken English.

If Indians were permitted a little more involvement in their children's education, they would be better able to point out the need for a useful orientation program to help prepare children who must continue their education in the cities. They could also encourage teachers to visit the homes of their school children.

. . . teachers would be welcomed in many homes but the Indian people are shy and so the teachers must make the first move. The teachers should take the initiative in expressing interest in visiting homes. She mentioned one teacher who sent notes home expressing his interest. The children gave the notes to the parents and some of the parents invited him to come and visit with them.

—Family H (Hobbema Reserve)

During a classroom discussion about teachers visiting the homes of school children, one teacher working in a northern Indian community said that teachers there tried to visit the homes but the parents refused them. On further questioning, however, it turned out that a carload of teachers came to visit each of the Indian homes. Most white parents would probably be filled with trepidation at the sight of a group of teachers piling out of a car parked in front of their home, unannounced.

Teachers visiting homes—and administrators giving them time to do so—is a controversial idea. This was made clear to me this summer by an Indian woman who had completed an orientation course for teachers of Indian children. She claimed that students were told *not* to visit the homes of Indians because of the possibility of talking about "politics." The fact remains that the "wrong" parents—in the sense that those who come are relatively well informed—tend to go to parent-teacher meetings. Those who do not come are those who, for their children's sakes, need to be reached most urgently. In trying to reach them, it is helpful to remember that many people feel more comfortable in the familiar surroundings of their own homes rather than within the confines of an imposing school building.

The families were relatively unprejudiced about ethnic differences as between teachers and taught.

I asked her if it is necessary for the teacher of Indian children to be Indian. She felt that the main thing is that the teachers should be good people. The topic of teacher aides came up and she said that it was a good idea to have Indian mothers as teacher aides.

—Family B (Edmonton)

What was striking about Indians along this line is their openness to

share, to accept white people, if only they—the whites—would make the first move.

What happens in most communities is that teachers tend to remain relatively ignorant about the daily lives of the parents and children with whom they are involved. On some reserves, teachers actually cluster together in motel units, with only the braver ones daring to venture out into the culture and the homelife of the people.

The influence of language on thinking and behavior is no secret. As long ago as the 1930s Rudolf Carnap (1937) and B. L. Whorf (1956) studied the influence of language, with the latter observing some of its effects on Hopi Indians. In our study, the effects of language along with other factors were strikingly evident when two families processed each other's data as well as their own. It is very important that fluency and flexibility of language behavior be encouraged.

Mrs. G. said that TV has helped her children; they pick up English and learn about other people as well.

—Family G (Hobbema Reserve)

During the year of the study I learned that I had some stereotypes about Indians—and that some of these stereotypes had been reinforced by Indians themselves! When I went to hear Kahn Tineta Horn (an outspoken Indian woman, who several years back won the title of Princess in the Canadian Annual Indian Princess Pageant) speak at The University of Alberta, she told of her brothers who were high steel workers, and she indicated that Indian children must have an education that is connected with the outdoors. I was startled, in discussing my findings with Indians and other people, how I also had associated Indians with the outdoor life, completely neglecting to take into consideration that *very few people*—Indians or whites—want to be “tied down” to a desk for eight hours a day.

While it may be stereotyped thinking to educate Indians solely for the outdoors, curriculum makers should not overlook the harmonious relationship which Indians tend to enjoy with nature, a relationship which is reflected in much of their talk and writing as well as in their lives. To overlook this relationship is to overlook a vast wealth of resources—to the detriment of Indians and whites alike.

There is much interest now in knowing more about the past and present lives of Indian people.

Mrs. A commented on her schooling and said they prayed fourteen times a day. I thought this was rather remarkable. She indicated that they prayed when they got up. They had mass before breakfast, they prayed after breakfast and on through the day. They also prayed for the Pope and they prayed for the Communists. She mentioned an arithmetic teacher who had come from Toronto who, she said, “was a real fanatic”. Every so often during the day, after they had finished their arithmetic, they would have to get on the floor and say some prayers. She said they also prayed for being sinners. She said she doesn't know how they could possibly have sinned except for the possible sin of everyone thinking they should kill the head nun.

—Family A (Edmonton)

It is good for people to know their own heritage and culture as well as the heritage and culture of others. But the argument is sometimes put forward that, by knowing about one's ancestors and customs, one be-

comes a better person. There may be some truth in this argument. But care must be taken that it does not cloud the fact that people feel good when they accomplish things successfully.

On an airplane trip last summer from New York to Buenos Aires, I sat next to a young man who was born in Italy, grew up in Argentina, then came to New Jersey where, through dint of hard work, he managed to save enough money to open a restaurant; a few years later, at the time of our conversation; he owned a successful restaurant and a house with a swimming pool in New Jersey and a small hotel in Italy. He observed, in broken English, that while he is not able to do many things, there is one thing that he can do better than anyone else in the world—and that is, make the very best pizzas. It seems to me that this is the attitude that must be fostered in schools. Each child must feel, within the realms of his own culture, that he can do something very well. Some may challenge this suggestion on the grounds of a lack of competition among Indians, but what may appear to be a lack of competition is, in reality, politeness on the part of Indians. (It is simply not good manners to show you know answers when others may not know them.) Polite behavior and successful accomplishments can go hand in hand in any culture.

Knowledge of one's own roots is vital, but the fact remains that young people must be able to perform well in school. Knowing one's own culture, while comforting, is not much help to the child who cannot read his books adequately. The books used in most classrooms on this continent are difficult for most children, and the educational problems are aggravated when there are additional potential hurdles like bilingualism and living away from home.

It would be educationally-beneficial for an interdisciplinary team to examine the data derived from this unique in-depth study of nine families and 40 children and then, after interviews with the *children of the families*, develop a meaningful language arts curriculum followed by an in-depth training program for teachers of Indian children.

There are still many questions to be answered; some are vitally relevant to the Indians. One question that still puzzles me is why Indians gave up their language and their religion so readily. True, many now have two marriage ceremonies—one of which is Indian—but most know little about their precious religious heritage, and if I were an Indian I would like to know what happened.

What is also surprising is why Indian leaders have not engaged in a more fruitful public relations program with nearby white communities. In some communities small groups of white children go to school on the reserve nearby, and *vice versa*. But the interaction is very limited. I recall an incident that happened when I drove for the first time alone to the Hobbema Reserve. I stopped at a gasoline station in Wetaskiwin, about ten miles away from Hobbema, filled up, and checked my directions. The teenage white boy was startled: "You're not going to the reserve by yourself, are you?" He told me he had never been to the reserve. That evening, while at the powwow ceremony. I thought of the young man and how much he was missing, even though he lived only ten miles away. In a very real sense *he* was culturally deprived.

There are questions in regard to the psychological impact of the *Indian Act* which have never been properly explored. It is good that Indians receive recompense and reparation for what happened years ago. But what does this inherent paternalism do to the initiative of Indians? Perhaps nothing, but it certainly seems a question worth exploration. For in a very real sense we are all displaced persons. Who among us has not had his roots torn, as if by a shudder of the earth? Who has been able to "hold fast to dreams"? Who has not experienced a sorrow, a loss, and a longing for the past? We are an uprooted people on this planet, and unless we can break the shackles of the past while extracting strength from our heritage we are all of us a lost people hurtling through space.

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Henry W. Hodysh
Editor 1977-1981

Hersom and the Development of Educational Research

It is difficult to identify a single article published in *AJER* during my tenure as editor that might be considered superior to the rest. Of the many that were printed each in its own way is a valued contribution to scholarship.

Naomi Hersom's "Twenty-five Years of Research in Education," a "Perspectives" essay, is of particular interest, for it provides a reflective analysis of *AJER*'s influence on the growth of educational research in Canada (Vol. 26, No. 4, December 1980, pp. 262-275). Mapping the journal's shifting emphasis from its appearance in 1955, she presents a synthesis of the central elements shaping the nature of research and examines the descriptive, analytic, and theory-oriented approaches that at various times dominated its interpretation.

Hersom's reminder that social and intellectual forces play a critical role in educational research is especially significant. Her observations neatly focus a vast and complex body of ideas, including, for example, the relationship between basic and applied studies, a question of increasing importance in today's rapidly changing educational scene. Other issues explored include the nature of theory and practice, the need for new approaches to the investigation of educational questions, and the challenges that would confront the research community in the future.

In keeping with *AJER*'s mandate to critique and disseminate ideas, Hersom identifies potential gaps in the creation of knowledge and, in the light of the journal's historical development, suggests alternative directions for better understanding the student, curriculum, and research at all levels of education.

PERSPECTIVES

Twenty-five Years of Research in Education: *The Alberta Journal of Educational Research* 1955 to 1979

Naomi Hersom

The University of British Columbia

To search more diligently and to be driven on by curiosity is commonly the lot of one who chooses to become a researcher. Prolonged contemplation of a problem and the periods when progress seems lacking or painfully slow are frequently prerequisites to that splendid moment of perception when something is seen to be true about the world. But the private moment belonging to the researcher alone is not sufficient. It must be shared, made public, opened up to the tests of others' perceptions and ideas, too. It is for this reason that the publication of the results of research is so vital—publication represents a formal invitation to criticism. And for a quarter of a century, *The Alberta Journal of Educational Research* has been one of the few publications in Canada which has afforded an opportunity for researchers in education to put forward the results of their efforts for careful scrutiny and for practical application.

It is intriguing to contemplate the interplay of events and ideas shaping the nature and direction of research activities in education primarily, though not exclusively, in the English-speaking world. The articles selected for publication in

AJER over its twenty-five year history provide a rather unique opportunity to do just that. While its editorial policies have developed and changed somewhat, the overall goal of presenting ideas that represent the best in all aspects of educational research has not. Accordingly, one can find in its pages examples of developmental trends in educational research that transcend international boundaries while at the same time demonstrating the ways such trends influence research being done in Canada. More specifically, *AJER* has reflected the research activity to be found in a university committed to fostering excellence in the study of education (Swift, 1970). At the outset of this retrospective look at the *Journal*, it should be acknowledged that the University of Alberta has demonstrated the seriousness of that commitment by its longstanding support of this publication. The *Journal* articles, seen as a whole, provide a mirror image of the ebb and flow of interests and emphases, the growth and decline of particular ideas, and the effects of change in society at large on the questions and problems addressed by researchers in education.

Educational research in North America generally has changed in style and scope within the context of demographic and other social changes surrounding the whole of the academic research enterprise. In Canada, we cannot set aside the extensive influence of public policies and government resource allocations for educational research in the United States which uninhibited communication of ideas and the extensive exchange of researchers has induced. One can argue that the pursuit of knowledge knows no bounds, but at the same time it would be foolish to discount the effects of the larger environment on the quality and quantity of research effort. With this presupposition in mind, an examination of the articles which have appeared in *AJER* suggests that there are at least three main sources of influence. Besides the national and international events, policies, public attitudes—the general milieu in which researchers do research in education—there are the ways in which researchers interact with one another and with the professional and public monitoring of their activities. More specifically, the *AJER* articles may be viewed as a fairly faithful reflection of the ways in which concepts about research in education have developed over a particular period: notions about what counts for valid knowledge, the appropriateness of various techniques and technologies, the interplay between the world of ideas in the social sciences and humanities and in education, the dissemination of research findings, and the effects, if any, of their application on practice.

The ecology of educational research in Canada

An ecological view of educational research by definition places emphasis on development in relation to total environment. Research in education, like research in the social sciences generally, grew rapidly following the Second World War. While social scientists claimed that their research would provide an understanding of humankind in general, which in turn would lead to the formulation of solutions to social problems, researchers in education focused on greater understanding of people in schools in order to formulate solutions to educational problems. Educational researchers in universities shared with their counterparts the conviction that analyses of processes and mechanisms would provide the knowledge required to resolve problems and to invent better policies and

practices. Governments viewed education as an economic investment by society that would produce better individuals, intellectually and personally, who in turn would be better citizens. Funding for research was increased both to help resolve social problems through education and to contribute to the quality of preparation for productive work and thought in Canadian society. Thus it was that educational research activity changed dramatically by the mid 1950's. It was no longer seen to be merely an activity to be carried out by professors of education during time not devoted to teaching; instead it was thought to be an instrument to be used to cope with the present and to influence the future.

At the same time, international events took place, heightening awareness of philosophical and scientific thought in education elsewhere, particularly in the Soviet Union. Reports and studies of differences in theories and practices and their resulting effects became sources of ideas for possible improvements in Canadian education. Later, when radical changes in American equity laws were so painfully being born, the course of educational research began to take on new directions. A preoccupation with ways to predict group achievement and to standardize treatments of groups began to give ground to a search for ways to provide equality of opportunity through education which would offset the effects of poverty and discrimination and would take into account the characteristics of individuals.

Thus one finds in the earlier volumes of *AJER* an article by Sparby (1959) addressing the relationship of research in education to the social sciences and the value of using an interdisciplinary approach, succeeded by a series of reports of research studies which depended heavily on social role theory to examine the behaviours of students, teachers, and administrators. The Greenfield and Andrews (1961) and Keeler and Andrews (1963) reports are typical of those studies undertaken with the specific intent of conducting educational research in order to improve the quality of schooling. The focus at the time was on the effectiveness of actors in fulfilling designated roles in educational organizations, but five years later, one of those authors (Greenfield, 1968) reassessed the use of the concept of role behaviour in educational theory and research and suggested new directions for future research. Or one can find, beginning with MacDonald (1959) a continuing interest in Soviet education: Stewin and others (1969, 1974) investigated the Soviet theory of set; Smith (1973) looked at Soviet studies in language acquisition; and Gulutsan (1967) was concerned with the relationship between the ideas of Piaget and Soviet psychologists. Similarly, a change over time appears in articles about tests and testing. In 1956, Clarke and Dunlop wrote about "Tests in Measurement and Evaluation" and studies on the use of standardized tests of achievement such as Sangster's (1956) gave way eventually to research growing out of the criticism of testing related to such factors as the effects of culture (Safran, 1963), anxiety (Frost, 1965), creativity (Cropley, 1967), and divergent thinking (Vernon, 1972). Gradually the ideas of Jean Piaget became more and more prominent in the studies appearing in *AJER*: in 1960, Crawford reported a study of Piaget's thought in relation to teaching school mathematics; in 1967, Côté's study of Piaget's formulations on perception and intelligence appeared; by 1973, O'Bryan and MacArthur had made an analysis of Piaget's notion of reversibility and Lefrançois had investigated Piaget's model of equilibrium through adaptation.

It can of course be argued that these themes appear in the pages of *AJER* largely because they reflect the choices of the referees and the editors of the day. To some extent that may be the case, but that is too simple an explanation. Final selections by editors are made from a pool of articles available, and that pool is the result of the research activity of people who have pursued ideas or who may have been supported in their pursuit of those ideas for a variety of reasons. It is not surprising that some of the research done in education and some of the motivations of researchers in education are related to social and political factors much larger than the educational enterprise itself. Sources of funding and demands for research in education which come from outside of the universities illustrate this point. The effects of such interventions are most apparent in the work in educational administration associated with the University of Alberta.

In the preface to Swift's (1970) volume entitled *Educational Administration in Canada*, Stewart describes the people who were involved in the process of establishing a special centre for studies in school administration at the University of Alberta. He cites the following as influential factors: an expressed concern among members of the Canadian Education Association in the first decade after the War that more facilities for post-graduate study in education be made available in this country; a disposition among Deans of Education in Canada to cooperate to that end and their attitude of good will toward the possibility of development at the University of Alberta under the leadership of H. T. Coutts, Dean of the Faculty of Education; the support of the Alberta Minister of Education, the University Board of Governors, the President of the CEA (in office during 1954-55); and Dr. Arthur Reeves, the person "who brought the scheme to fruition" by preparing and promoting the proposal for the CEA-Kellogg Project (pp. *iii, iv*). The W. K. Kellogg Foundation offered support for an action program

which would have an immediate and beneficial effect on the educational process and, perhaps more important, which would serve to set in motion programs which, having demonstrated usefulness, would be taken over, and be financially supported on a continuing basis by Canadian school authorities and educational institutions. (pp. 13-14)

Subsequently, as Swift suggested, a program of research was undertaken which was unlike the kind of research "as that term was generally understood." Examples of some of the studies completed in large part because of the mandate given to the Department of Educational Administration at the University of Alberta, funded by the Kellogg Foundation initially, and later by the University's own resources, are to be found throughout the pages of *AJER*. The articles provide some evidence that the concerns of practitioners, as voiced by the Canadian Education Association, and the concerns of informed members of the larger public, as represented by the Kellogg Foundation, had an effect on the course of research in education. In this case the interdependence among groups was overtly welcomed by Dean Coutts and the Faculty of Education, and the outcomes have been documented in considerable detail by Swift. One suspects that in other areas of educational research, "outside" influences have not been recognized as clearly but are nevertheless no less active in shaping educational research efforts.

The influence of the scholarly community

Another of the factors shaping the nature and direction of educational research is almost certainly the type of program designed to prepare researchers (Willson,

1980). The majority of the programs offered in North America twenty-five years ago were embedded in the requirements and traditions of university faculties of graduate studies. The practice continues to a great extent today. The overall result is that the ideas of the scholar-models in universities who supervise theses and who are members of thesis committees have a long-term influence on the types of problems addressed by researchers in education and on the means of exploring them. With the growth of graduate programs in the faculties of education in Canada, more professors and an increasing number of graduate students carried on this academic tradition and, quite naturally, shared beliefs and assumptions about the research enterprise. It also seems reasonable to suppose that a centre like the Division of Educational Research at the University of Alberta, in the process of facilitating research activity, has been instrumental in reinforcing ideas and developing standards of excellence in educational research.

In some cases the traditions are longstanding and deeply rooted, such as in the field of testing and test development, and researchers have consistently addressed certain basic issues over time. In 1956, *AJER* published Powell's evaluation of the "Detroit Beginning First-Grade I.Q. Test" in terms of its validity, reliability, and standardization. In 1974, an article by Randhawa, Hunt and Rawlyk reported a study which included, among other things, an examination of the reliability and validity of the "The Canadian Cognitive Abilities Test." These and other studies focusing on the technical aspects of perfecting tools-to-be-used share certain characteristics handed down through a long line of researchers. Walker's article in the 1959 volume, assessing the influence of Binet after half a century had elapsed, was possible partly because certain presuppositions about the nature of learning and testing remained relatively constant among groups of researchers. This is not to imply that the field remained static, but that there had been a certain kind of continuity. Changes were introduced when some researchers became concerned with studying the effects of tests-in-use (Frost, 1965), or when the need for tests based on different kinds of assumptions about the nature of learning and thinking came to be held by the scholarly community (Hobbs, 1975). But, overall, it can be said that those scholars in education who see themselves primarily as researchers concerned about the application of the methods of social science research to the problems of education have actively sought to improve the quality of their research and to strengthen programs for training researchers.

What may be seen to apply to the influence of the whole community of scholars in education nationally and internationally may also be seen to affect the research activities of groups of scholars who share an interest in a particular subject area or, on a small scale, among scholars located in a single institution. When fairly stable associations are maintained over the years, expectations for research are built up which are productive and influential for students and colleagues alike. One sizeable group of articles published by *AJER* seems to illustrate this phenomenon. Beginning in 1956 and continuing regularly throughout the pages of *AJER*, there are reports of studies on school mathematics programs, the preparation of teachers of mathematics, and the performance of students doing various types of mathematics tasks. The researchers whose names are associated with some of these studies seem to indicate the effects of

longstanding associations among researchers in mathematics education: Nelson and Worth, 1960; Nelson, 1964; Nelson and Towler, 1967; Liedtke and Nelson, 1968; Bana and Nelson, 1977; Bourgeois and Nelson, 1977; Nelson and Kieren, 1977; and Kieren and Nelson, 1978.

Another facet of this phenomenon of commonality in research interests and the effects of leadership on research directions seems to be apparent in the body of work published by *AJER* related to Soviet scholarship. The heritage of western Canada in particular has been enriched by its Eastern European roots and by those Canadian scholars who have maintained communications with European scholars, specifically with their Soviet counterparts. At the University of Alberta, Gulutsan (1967) was a founding member of the interdisciplinary Centre for Eastern European Studies and it is noticeable that several of his colleagues in the Department of Educational Psychology, coming themselves from a variety of research traditions, produced a number of studies analyzing various aspects of education in the Soviet Union. MacDonald (1960) wrote "Explanation and the Neo-Marxist Theory of Mental Testing" at a time when the race to explore space was reaching its competitive heights. A decade later, Hritzuk and Janzen (1970) studied the concept of set held by two Soviet psychologists, Luchin and Uznadze, followed by Lefrançois' (1973) account of behaviour theory, and by Cowper and Stewin's (1974) experimental critique of Soviet set theory. Other psychologists, like McLeish (1974), examined certain features of Soviet education from a social system perspective or, like Stewin and Martin (1974), from a developmental perspective. It would be dangerous to ascribe disproportionate effects to the influence of scholars on one another, but it does seem reasonable to identify personal interests and group contributions among those factors which, for whatever sets of complex reasons, have led researchers to follow one course of inquiry rather than another.

This same factor seems to be present in part in the process of change which can be seen in the research on teaching and teacher preparation during the past twenty-five years. At a time of teacher shortage in North America, Clarke and Pilkington (1955) and Aikenhead (1956) investigated the reasons why students and practising teachers were not choosing to enter or to remain in the profession. Their studies used questionnaires designed to assess the opinions and attitudes held by teachers and others. In the next decade the focus of research shifted to teacher performance in the classroom and attempted to identify the kinds of knowledge and behaviours associated with successful teaching. So, for example, Eddy (1963) studied "Teacher Characteristics and Social Studies Achievement" and McBride (1964) investigated student assessments of teacher performance based on the assumption that when students are generally satisfied with their experiences in a classroom they will derive greater benefit from the teaching and the learning experiences offered to them. By the mid-1970's, the notion of the effect of teachers' attitudes towards pupils and teacher-held expectations for pupil performance became predominant in the research. Lavoie and Adams (1974) conducted a field study to ascertain the ways teacher expectations may be affected by children's physical attributes, sex, and conduct. Hoxter (1974) investigated teacher attitudes to find out how these affect students who come from cultures other than the teacher's own. Miller (1974) studied changes in student teacher

attitudes towards children and schooling, reflecting the changes in values held by students throughout the period of preservice professional education. Recent research has continued the emphasis on the internal rather than the external factors related to success in teaching. Where the work of Clarke and Pilkington (1955) emphasized the effects of public opinion and of home and school influences on prospective teachers, Noll, Willower and Barnette (1977) directed attention to the teacher as a person by using measures of "self-actualization" and measures of attitudes in terms of "pupil control ideology" to predict the nature of teaching behaviours, and Cheong and Wadden (1978) used measures of teacher attitudes to predict effects on pupil self-concept.

If my initial presupposition holds true, that *AJER* can be seen as a sort of weathercock for directions in the developments taking place in educational research in North America, then the articles to be found in its twenty-five volumes to date reveal something of the state of the art in Canadian research on teaching and teacher education. Although one would expect to find many educational researchers making the investigation of teaching and teacher preparation programs central to their work, especially since so many are conducting their studies in the context of professional faculties, this does not seem to be the case. The studies appear to be so diverse that it is difficult to find ways in which research findings could contribute over time to the building of an adequate body of knowledge. Some possible explanations for this state of affairs seem to emerge from an overall examination of the reports of research appearing in *AJER*. One observes that there is an almost exclusive association of researchers within a discipline or a field of study but little association across disciplines. While inquiries by researchers in educational philosophy, sociology, psychology, and history or administration and curriculum are ongoing, few of the studies have been undertaken in an attempt to work across discipline lines or to synthesize findings in order to discover general principles or theories. Work like Lindstedt's (1960) study on "Teacher Qualifications and Grade IX Mathematics" identified certain features characteristic of preservice teacher education and subsequent teaching experience in schools that can affect the levels of competence attained by teachers of mathematics. Greenfield and Andrews (1961) identified certain types of teacher behaviours that can be associated with pupil achievement on school examinations. There seems to be little evidence of concern on the part of the community of educational researchers to take the findings of such studies consciously into account when planning subsequent investigations. Even though a researcher like Poole (1975) set out to find ways to improve teacher education programs by identifying component skills of teaching and by deliberately training people to generate ideas on the assumption that this would make for more creative teaching in the classroom, the study was conducted on a relatively small scale without benefit of cross-consultation with other researchers such as I have envisaged. Of course, one might argue that a great deal of the research conducted in education implies the need to know more about teaching and teacher preparation and thus contributes to our knowledge indirectly. But, historically, the resolution of difficult problems in any field of inquiry has not come about by circumventing them. Obviously, different researchers will use different approaches in searching for new knowledge and may even be in sharp disagreement with one another in their views of the best approaches to take, but they share in a common

pursuit and the influence of the community of scholars makes itself felt. In the community of scholars in education there appears to be lacking a continuing, persistent commitment to the kind of research that boldly identifies itself with the intent to pursue new ideas, to invent new practices, to resolve longstanding problems which would lead to the improvement of university and field programs in teacher education.

The traditions of the scholarly community can be tremendously productive but there is a danger that those same traditions will become paternalistic and conformist in their effects on research. The apprentice researcher who is introduced to a particular mode of conceptualizing problems-to-be-solved in education may find it difficult to accept or to explore other ways of thinking and to use alternative modes and techniques of investigation. The myth of "the scientific method" has influenced research in education in North America as it has in other fields of inquiry and has played a predominant role in the research in education reported in *AJER*.

The extension of knowledge in education through research

To this point the *AJER* has been viewed partly as a product of its time and place and partly as an illustration of the several ways the community of scholars in education shapes the work that is ongoing in the field of inquiry. Undergirding both perspectives are certain basic notions about what educational research is and what counts for valid knowledge in education. Is research in education basic or applied and, if it is thought to be applied research, does that mean it is applicable to further academic study or to practice, or to both? Baxter (1980) argues that research in the applied sciences is "basic in the sense that it is concerned with knowledge and methods that might be applicable in a number of different situations" and thus it enjoys a kind of strength and versatility which would not be possible if it were highly specific (p. 3). Others would draw the line more clearly between basic and applied research. Mattersich (1980) distinguishes basic from applied research by emphasizing its intents: when research is directed toward increasing knowledge it can be termed basic; when it is directed toward practical applications of knowledge, means-end relationships, or the resolution of specific problems, it is applied research. Using the Mattersich definitions, it can be seen that *AJER* has interpreted its mission to publish research in education broadly enough to include studies that lie within each of the two categories of intentionality. It can also be seen that the greater number of studies lies in the application of knowledge category.

A selection of 25 of the studies on reading reported from 1955 to the present illustrates this weighting. The earlier studies such as the one by Carmichael and Rees (1955) surveyed reading achievement levels attained by Alberta pupils in order to discover whether or not they were meeting standards attained elsewhere. The results of comparisons like these were intended for use by practitioners who, presumably, would take them into account when planning curriculum and instruction in reading. An experimental study of Koziey and Brauer (1972) described methods of teaching reading which demonstrably improved reading performance. These and other studies in this particular group of articles were clearly intended to assist practitioners with the resolution of problems encountered by teachers in the teaching of reading or by pupils in learning how to

read. By comparison there are relatively few articles reporting research deliberately devised to discover new knowledge about reading and language phenomena. Stewin and Anderson (1974) tested the power of the concept of cognitive complexity in information processing; Evanechko, Armstrong and McFetridge (1974) explored the semantic organization underlying verbal behaviour; Cummins and Gulutsan (1974) focused on cognitive growth; and Smith (1973) searched for understanding in terms of language acquisition concepts.

Whether *AJER* articles report findings from applied or from basic research studies, one is struck by the consistent emphasis placed on matters of method and technique in the majority of them. Perhaps this is not too surprising in view of the metamorphosis which has taken place in social science research in the post-war years. The earlier volumes of *AJER* contain reports of studies that are predominantly descriptive presentations. These are succeeded by reports of studies which used analytical-empirical approaches in the attempt to adapt scientific methods to education problem-solving. From the mid-1960's on, there is concern for more rigour, and for more emphasis on the development of theories and models (Holdaway & MacIver, 1966), methodology (Maguire, 1969), and new techniques (Hunka, 1971). It was during this period, according to Gephart (1980), that researchers in education became preoccupied with five major types of problems in the conduct of research: problems of analysis, treatment, representativeness, measurement, and logic, which even yet have not been satisfactorily resolved. One detects in a few of the articles published after 1970 the adoption of a different philosophy of science, one which takes into account the researcher as person, an integral part of the research enterprise. Nevertheless, the research methods and techniques employed most frequently in the articles appearing in *AJER* are those which were developed originally for studies in agriculture, biology, or psychology.¹ It is exceptional to find reports of studies making use of interview, historical, case study, content analysis, opinion poll, or survey sampling. Of fifty-four articles published in *AJER* from 1955-1979 which designate teachers or teaching as a research focus, only six reported the use of such techniques as economic prediction, field study, Delphi study, case study, or interview procedures.

Educational research has come to be almost exclusively associated in the minds of some people with the use of systematic descriptions and measurement, observation, and controlled experimentation, or the creation of instruments to test knowledge through verification, confirmation, or falsification. Proportionately larger numbers of educational researchers in North America have been committed to the use of this particular methodology, resulting, one would expect, in a large pool of articles from which to select those for publication. Thus, while the articles in *AJER* represent the prevailing trends in educational research for the past twenty-five years, at the same time they provide a silent commentary on the comparatively limited number of research studies conducted using other forms of inquiry. This makes for an imbalance that skews the image of what counts for research in education. Eastwood's (1975) comment appearing in Volume XXI seems particularly pertinent in this regard:

No one would wish to suggest or be accused of suggesting that a technological research pattern is an adequate or appropriate model for educational research.... Human learning and human development are considerably more complex processes

than the development of a new machine. But both are practical activities dependent upon the application and utilization of basic research and both necessitate research in ways of applying. (p. 74)

The effects of publishing educational research

The experience of delving into twenty-five volumes of *AJER* has forcibly reminded me of the diversity of questions confronting researchers in education. Some are conceptual, others are methodological, and still others have to do with the relationship between research and practice. Clearly, the raising of such questions as a stimulus for further thought and research activity is one of the primary functions of the *Journal* and one it has performed well for its readers over the years. It is consistent with the statement of purpose set out in the masthead: *AJER* is intended to be

A quarterly journal devoted to the dissemination, criticism, interpretation and encouragement of all forms of systematic enquiry into education and fields related to or associated with education.

My overview has indicated a few of the ways *AJER* has so admirably fulfilled these goals. It has also served to whet my appetite for more information about what the field of educational research was like at the time each of the twenty-five volumes was in process of preparation for publication. Editors of major research journals such as *AJER* read the assessments made by knowledgeable reviewers of hundreds of manuscripts; they make informed decisions about selections; they interact with authors representing research in disciplines using different forms of inquiry. I think it would be valuable to know more about the issues in educational research that consumed the interests of authors and editors of the day. I can only speculate a little about the effect that the inclusion of editorial statements might have had. If editorials serve to highlight issues important to the mission of a given publication, might the editors of *AJER* have been able to communicate some sense of the issues and events and the world of ideas in educational research? Might they have sharpened insights or created linkages that could have intensified or multiplied the effects of ongoing research? Would such editorials have helped us to appreciate their perceptions, so well described by Hodysh (1971) as the compound of needs, values, hopes, past experience, and culture used to organize and to direct interpretations of reality?

I applaud the invitation first extended in Volume 24 to provide opportunities for scholars to write critically about the general conduct of research in education (Hodysh, 1978). Essay reviews, book reviews, and expressions of points of view in "Perspectives" pieces are being included in a deliberate effort to present the questions being raised in the larger world of research, the debates about premises, the shifts in what is taken for granted in educational research. Even so, there are problems in publishing matters of current concern; it takes time for the cycle of the research process to come round to the publication stage. This publication time-lag continues to be a dilemma in disseminating ideas and research results because of the benefits that accrue from criticism and revision prior to publication. The provision for alternative types of articles should encourage those who would challenge our existing ways of thinking and those who can generate excitement about the search for knowledge.

But having said these things, I must conclude by acknowledging the far-reaching positive effects of the research articles published by *AJER*. There is very substantial evidence in articles appearing over successive years demonstrating that the conduct of research in education has been facilitated by publication of work leading to the refinement and improvement of measures and methods. There is also evidence along the lines Suppes (1978) has identified for North America generally, that knowledge derived from basic research has had an effect on practice in education: policy decisions about the content and organization of curricula in science and mathematics have been influenced by Piaget's notions of conservation; certain expectations about students and teachers have been modified in light of findings in social psychology; and work in the social sciences and humanities has changed some concepts about the training of administrators, to take just a few examples. *AJER* came into being at a time when the vision for the development of educational research in Canada was fresh and exciting. It is impossible to assess precisely the extent to which the *Journal* helped to translate that vision into reality, or to gauge exactly the extent to which the vision itself shaped the development of *AJER*. Traces of both of these factors are to be found throughout the twenty-five volumes of the *Journal*. It is a singularly fine record of many of the achievements and of some of the struggles in educational research in Canada and abroad.

And what of the next twenty-five years for *AJER*? At a time when large numbers of publications in every field are in peril of disappearing, my hope is that *AJER* will continue to flourish. From its earliest beginnings to the present time, it has played an important role in the whole of the educational research enterprise in Canada. It may be that this role can be sharpened somewhat. The time seems propitious, with the appointment of the panel of widely representative Consulting Editors, for the *Journal* to assume responsibility for actively identifying gaps in knowledge and needed research in education. *AJER* might deliberately assume responsibility for bringing together a critical mass of knowledge from which the members of the teaching profession as well as scholars in education could draw applications. Or, perhaps, the *Journal* might consciously assume a special responsibility for disseminating the results of research studies that will further, in the broadest sense, our understanding of teaching and schooling and the education of practitioners.

The resilience demonstrated by *AJER* in its first twenty-five years of publication will surely stand it in good stead now. It has been characterized by a sense of purpose and by those qualities of vitality and perseverance which are needed to sustain it through periods of change. These are qualities that will enable *AJER* to continue to make important contributions to the study and practice of education in Canada in the years ahead.

Notes

1. For a useful comparison, see V. L. Willson, Research Techniques in *AERJ* articles: 1969-1978. *Educational Researcher*, 1980, 9(6), 5-10.

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Henry W. Hodysh

Educational Research in Transition: An Historical Perspective on Editorial Change

The mandate of *The Alberta Journal of Educational Research* (AJER) to critique and disseminate the results of educational inquiry has focused the attention of the journal's editors ever since its appearance in 1955 (Coutts, May 1993, personal interview). For Canada's first journal of educational research, this commitment engaged a broad cross section of the academic community.

From AJER's inception (Buck, 1994), its editor H.S. Baker had the support of the Alberta Advisory Committee on Educational Research and the Faculty Committee on Educational Research, including such individuals as H.T. Coutts, S.C.T. Clarke, and H.E. Smith (AJER, 1955). A concern for the journal's intellectual and organizational well-being was indicated in G.M. Dunlop's plea for "wider assistance and cooperation of interested individuals throughout the province" (1956, p. 6). This initiative was furthered in 1965 when an Editorial Committee under G.R. Eastwood introduced a new set of editorial policies (1965), leading in 1966 to the formation of an Editorial Board comprised of professors from the University of Alberta and the University of Calgary (AJER, 1966). One year later, P. Lane assumed editorial responsibility for "the discussion and disposition of manuscripts" (AJER, 1967). She was followed in turn by editors E. Miklos, J. McLeish, T. Kieren, and A. Clark. By the early 1970s, the efforts of the editors and their associates had already contributed to a wide readership and, according to the publications assessors of the Canada Council, a well-deserved reputation as a leading journal of educational research (Canada Council, 1971).

When I became editor of AJER from 1977 to 1981, my twofold intention was to heighten its international profile and provide for different approaches to the interpretation of educational research and debate. To achieve the first objective, a panel of Consulting Editors was established to assist in the review of manuscripts (Hodysh, 1978a). The panel, representing scholars from Europe, the United States, Canada, Great Britain, and Australia, provided expertise in a variety of educational areas that extended beyond the valued assessments of the journal's Faculty Publications Committee.

During this period, two new categories for the publication of educational research were introduced. In a "Call for Papers," manuscripts were invited for "Perspectives" and "Essay Reviews" (Hodysh, 1978b). Presenting a "speculative or philosophic point of view," the purpose of the "Perspectives" manuscript was to challenge fundamental understandings of research by suggesting alternative directions of thought and argument. The "Essay Reviews" called for a comprehensive analysis of recently published educational research, transcending the depth of analysis already evident in AJER's "Book Reviews" section.

The attempt to foster continuing debate among scholars also led to the introduction of "Research Notes" (Nyberg & Nyberg, 1980) and "Rejoinders" (Wright & Elliott, 1981; Parsons, 1981; DeFaveri, 1981). Whereas the "Research Notes" allowed for a short but focused critique of a problem or technique in research, the "Rejoinders" were limited to a brief exchange of views usually between an author of an article and a critic, reviving a tradition founded in an earlier edition of *AJER* (Anderson, 1960).

Whether these developments have advanced the cause of educational research is possibly a judgment of time. What they do suggest is the need for each generation of educators to define a journal in its own way. A journal's concern with such questions as the relative significance of basic and applied educational study and the direction research should assume becomes, however, more than a decision of any one individual. It reflects a recognition of what has gone before and, more importantly perhaps, what scholars today both in and outside of the educational community believe is of most worth.

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Walter H. Worth

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Perceptions

There are three reasons for advocating the reprinting of Neil Johnson's (1987) article that appeared in the "Perspectives" section of *AJER* a decade ago.

One is to highlight the desirability of *AJER* continuing to provide a forum for the publication of articles that offer a point of view or state-of-the-art review about an issue or concern in educational research. Such reflective or interpretive essays can help in overcoming conceptual and methodological weaknesses in conventional research studies.

Another is because the article focuses on the basic ingredient of educational research—perceptions. These preferred approximations of reality as defined by researchers and their subjects shape both the processes and the outcomes of our endeavors. Accordingly, it is imperative that we understand what perceptions are, and how they develop and influence behavior. Equally imperative is our need to use such knowledge to devise methodologies that enhance the trustworthiness of scholarly inquiry.

Johnson's article, written when naturalistic research was becoming trendy, addresses these twin imperatives. It examines some current developments in perception theory and research as a basis for generating some generalizations about perceptions. The pertinence of these generalization for both consumers and producers of research is then discussed, including an examination of means to limit the potentially prejudicial impact of perceptions on educational research.

A further reason for drawing attention to this article is to encourage someone to prepare an update on the current state of our knowledge about perceptions and how to cope with them in ways that will enhance the trustworthiness of our investigations.

PERSPECTIVES

The Pervasive, Persuasive Power of Perceptions

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Through their influence on attitudes and behavior, perceptions are central to both practice and research in education. This article examines some leading developments in perception theory and research, particularly in respect of (a) the influence of perceptions on behavior, (b) the accuracy of perceptions, (c) the capacity of individuals to express perceptions, (d) perception processes, and (e) major factors influencing perceptions of persons and social events. This discussion leads to the presentation of seven generalizations about perception and a consideration of their implications for all who engage in educational endeavors. Most importantly, it serves as a basis for examining means to limit the potentially prejudicial impact of perceptions on educational research.

Perceptions shape human attitudes and behavior; their impact is pervasive and unavoidable. They provide bases for understanding reality—objects, events, and the people with whom we interact—and our responses to them. Thus perceptions dominate all the situations that educational and other social researchers study. Perceptions also focus the work of the researchers themselves—the behaviors researchers notice and choose to record, the opinions they invite from others, and the theoretical perspectives within which they interpret data and frame conclusions.

An initial intent of this article is to draw attention to extant knowledge about the nature of perception and the factors that affect the perceptions of individuals in educational organizations. This provides a basis for advancing a framework of factors associated with perception and for considering important implications of perception theory for educational researchers and practitioners. Researchers, in particular, need to be conscious of the pitfalls inherent in relying on their own and others' perceptions.

The ideas presented were drawn from the literature, from the author's discussions with researchers and educators, and from personal experience.

The Pervasive Influence of Perceptions on Educational Practice and Research

Practitioners in educational settings deal with perceptions constantly. They are first employed and then evaluated substantially in accordance with perceptual impressions. Instructional practices, administrative decisions, and policy initiatives are guided by perceptions of individuals and educational needs, as are responses to the actions of coworkers and others. Knowledge of employees' and other stakeholders' perceptions helps administrators to revise educational policy and change individuals' experiences in educational organizations, and knowledge of perception theory may provide an avenue for directly improving educational leadership and practice.

Educational research also involves scholars in these situations. Seeking knowledge of the interactive behavior, personalities, attitudes, and emotions of practitioners, researchers enter university and school classrooms, the offices of administrators, and a variety of other locations to elicit perceptions from policy makers, administrators, instructors, and students. For those investigators who desire no more than understanding of attitudes and feelings, perceptions are paramount. And, because behavior occurs in response to perceptions, perceptual data also hold a key to researchers' knowledge of organizational behavior. Some scholars use questionnaires and interviews to gather perceptual data for quantitative analysis. Naturalistic researchers and policy analysts also rely on perceptions stated by others, and they document their own perceptions of organizational events and environments. Researchers using interpretive orientations value perceptions as indicators of the realities for individual educators. Conceding that an objective reality can be known only through the filter of perceptions, researchers of a rationalistic bent also depend on perceptions—as surrogate measures of reality. Doubting the trustworthiness of their data, some scholars explore perceptions still further, using a variety of sources, strategies, and investigators to corroborate their research findings as true and full representations of life in educational settings.

If educational research is to make important contributions to knowledge, researchers need to become conversant with the nature and processes of perception and with the factors that shape and can bias the perceptions of those engaged in research and practice. This will allow them to address personally and methodologically the trustworthiness of their scholarly endeavors.

The Nature of Perception

A Problem with Definition

To date, the notion of perception has resisted clear and conclusive definition. Once regarded simply as "sensation plus meaning" (Bartley, 1980, p. 5), most psychologists now view sensation as a physiological experience and perception as a cognitive activity (Krech, Crutchfield, Livson, Wilson, & Parducci, 1982). Perception and other cognitive activities such as "inferring, categorizing or judging" (Tajfel, 1969, p. 316). Despite this conceptual uncertainty, there is broad consensus that perception is "the understanding of the world that you construct from data obtained through your senses" (Shaver, 1981, p. 83). As Shaver noted, such a definition implies that perceptions are obtained through sensory experiences rather than merely by reflection or intuition, that an objective world exists outside the perceiver, and that the perceiver actively forms an impression from each stimulus.

Developments in Theory

Investigation of physiological sensory processes (e.g., Bartley, 1972; Hochberg, 1978) has been unable to account fully for perceptual experiences, so many psychologists have paid closer attention to the complementary psychological dimension. To this end, structuralists tried to expose and describe the characteristics of and relationships between aspects of conscious experience (Dember & Warm, 1979). Gestalt theorists criticized those attempts to decompose total perceptual structures and focused instead on how individuals perceive situations as a whole (Moates & Schumacher, 1980). Allport (1955, pp. 576-612) extracted from 13 "specialized, divergent, and often discordant" theories of his time eight major generalizations (most of which survive in current theories): (a) individuals aggregate and interrelate multiple understandings of events; (b) these "perceptual aggregates" are organized within limiting conceptual boundaries; (c) perceptions are assembled over time; (d) although general order and stability prevail, some perceptual inconsistencies are tolerated; (e) perceptions remain relatively constant over time; (f) there is a tendency to return to original "steady state" perceptions following the disruption of new impressions; (g) impressions are weighed unequally in perceptual aggregation; and (h) although perceptual aggregates sometimes conflict, usually they mutually support higher-order perceptual generalizations. Kelly's (1955) "role-construct theory" emphasized interrelationships among the individual's perceptions, interpretations, and behaviors: By developing "constructs," or categories of events, the perceiver forms expectations and plans behavioral responses; and comparison of new perceptions with existing systems of constructs validates current understandings and classifications of people, objects, and events. Likening perceptual processes with computer system procedures, however, "information-processing" theorists contended that perception occurs only after sequential transformation stages: stimulus, sensory store, perceptual image, memory, and response. Moates and Schumacher (1980, p. 276) noted that, whereas Gestalt psychologists "had a remarkable flair for capturing the intuitive aspects," information-processing theory helped to "formalize the sometimes vague gestalt ideas so that they are more testable." The study of "social perception," as yet still "in its infancy," focuses specifically on three important avenues of research: (a) study of the effects of social interaction on perceptions of physical properties; (b) investigation of perceptions of individuals' physical and social characteristics; and (c) exploration of perceptions of social relationships and events (Hochberg, 1978). The latter, of primary interest to educational researchers, includes the emerging fields of attribution theory and implicit personality theory.

The Perception Process

Perceptions seem to be formed in a series of cognitive steps. A common view is that a perceiver selects and categorizes sense data within predetermined structures, or frames of reference; in turn, these are subject to attributes of personality (Kelly, 1980).¹ According to Bruner's (1951) "expectancy or hypothesis theory of perception," three stages are involved: the individual hypothesizes about the occurrence of a likely event ("hypothesis"), the environment provides an informational stimulus ("information"), and this prompts a confirmatory response from the individual ("confirmation") (pp. 121-127). Moates and Schumacher (1980, pp. 16-17) advanced a more detailed explanation: sensory receptors are oriented toward a source of stimulation; certain features and contextual factors are extracted (noticed); and then the perceiver engages in "a cyclic process of orientation, feature extraction, comparison with memory, and then additional orientation, feature extraction, and comparison," permitting

the perception to be incrementally refined. This "chain of perception" process (Krech et al., 1982, p. 103) accords with Litterer's (1973, p. 108) "selection-closure-interpretation" explanation and Forgas and Melamed's (1976) description of a sensation-perception cycle.

Four questions about this perception process are of central concern to educators and researchers: (a) To what extent do perceptions affect behavior in educational and other social settings? (b) Are members of educational organizations able to consciously identify and express their perceptions? (c) How accurately do perceptions portray reality? and (d) Are perceptions shaped by identifiable and commonly occurring factors?

Perceptions and Behavior

Through a process of "discovering what the environment is really like and adapting to it" (Neisser, 1976, p. 9), perceptions shape the social behavior of individuals. Perceptions allow individuals to understand, anticipate, and react to environmental circumstances, events, and the behavior of others (Forgas & Melamed, 1976; French, Kast, & Rosenzweig, 1985; Harvey, Weary, & Stanley, 1985; Wrightsman, 1977). Blake and Ramsey (1951), Litterer (1973), and Kelly (1980) also highlighted perceptions as the critical determinants of behavior in organizational settings and, although Tagiuri (1969, p. 435) warned that other factors also impose on social behavior, he concluded that, "if there is to be a science of interpersonal behavior, it will be based, to some extent, on our learning more about how people come to perceive other people as they do." Hochberg (1978, p. 242) also regarded the study of perception as "an important tool for understanding and predicting behavior" in social situations, and Shapiro and McPherson (1987, p. 75) recently focused attention on public policy makers' perceptions of policy dilemmas as "an important determinant" of their "policy behavior."

Understanding of perception is therefore critical for educational research and practice, for social behavior in educational settings is guided not merely by an assumed objective reality but by actors' individual perceptions and by the factors that shape and distort those perceptions.

Capacity to Express Perceptions

Though instrumental in determining behavior, many perceptions are beyond the capacity of individuals to consciously recognize and verbally express. Cameron and Whetten (1983, pp. 12-13), for example, concluded from organizational effectiveness research that

There appears to be ample empirical evidence . . . to suggest that individuals frequently cannot report accurately the criteria of organizational effectiveness that they implicitly hold. Nor are they aware of the factors that motivate their judgments or evaluations of an organization. When researchers ask various constituency members to specify important criteria of effectiveness, there is no assurance that the criteria they enumerate will be consistent with the criteria they use implicitly to judge effectiveness.

Cameron and Whetten supported this view by citing research that asked organization members to rank "47 different goals in their institutions"; none received particular priority. Clearly, these authors' assessment was based on an especially onerous demand on the recall and cognitive organizational capacities of respondents. Nevertheless, it does signal a potential danger in seeking perceptual measures of individuals' impressions about abstract organizational attributes.

How Accurate are Perceptions?

On the matter of perceptual accuracy, Rock's (1975, p. 5) research findings are encouraging: "granting that the perceived world is different from the world that is the object of perception, one can still say that there is a high degree of correspondence." If so, we may treat perceptions as broadly accurate indications of the "real worlds" of educational organizations. On the other hand, the literature also includes numerous references to "illusions" attesting to a clear discrepancy between reality and perceptions of objects. Of course, the accuracy of perception of social events is more difficult to measure, for phenomena that defy direct inspection and measurement can be known and understood only through a process of perceiving; if individuals' perceptions of an event agree, we can only assume that they reflect reality (Rock, 1975; Shaver, 1975). Even so, Gladstein's (1984) research and a range of studies reviewed by Wrightsman (1977) disclosed a pervasive human incapacity for perceiving and recalling either objective or social events with accuracy—a finding that supports Allport's (1961) generalization that "good judges" are rare and Blake, Ramsey, and Moran's (1951, p. 5) conclusion that "sometimes . . . it is not difficult to show that the margin of interpretative error is very wide." Clement (1978) blamed selective perception for this apparent disparity—selections that, of course, differ among individuals. Availability of information is an associated problem: possessing only fragmentary information, individuals are frequently obliged to make perceptual assumptions and hold personal expectations which lead them to perceptions that diverge from reality and from those of other witnesses (Hochberg, 1978; Litterer, 1973). Hochberg (1978) further identified three common causes of perception-reality discrepancy: (a) events that cannot be discerned; (b) omissions, additions, and distortions arising out of human perceptual processes; and (c) events whose significance is misunderstood. Differing histories of perceptual learning, attention, and intentions also lead individuals to form different impressions of events and persons.

As much of the research and our personal experience tell us, individuals' perceptions of social events frequently differ. For example, we may expect an instructor, an inquiry-oriented student, and a student motivated only by threat of examination to perceive the purpose, product, and quality of a shared seminar experience quite differently. Hence educational practitioners and researchers would do well to draw on a variety of perspectives and to recognize the limitations of their own and others' perceptions when forming impressions and making decisions. For many researchers, in particular, reliance on multiple data sources may increase the convergence of perceptions and thus the likelihood of discovering a shared or objective reality.

Despite inaccuracy, there is often considerable consistency in social perceptions as well as in the biases that cause individuals' perceptions to depart from reality and the impressions of others. Perception research has disclosed a range of central influences—summarized in Figure 1 and discussed below—that can help us to understand and account for the effects of perceptions on educational research and practice.

Factors that Affect Perceptions

Perceivers arrive at their limited, differing, sometimes distorted impressions of persons, objects, and events only after influence from a range of complex and subtle factors. Despite an initially bewildering array of influential factors, certain "perceptual determinants" emerge as common among perceivers (Blake et al., 1951, p. 8). Scholars have classified them in a variety of ways, such as familiarity, strength, and salience of stimuli (Kelly, 1980) and "experience, intelligence, and empathic ability" of perceivers (Shaver, 1975, p. 22). Most comprehensive are Forgas and Melamed's (1976) four

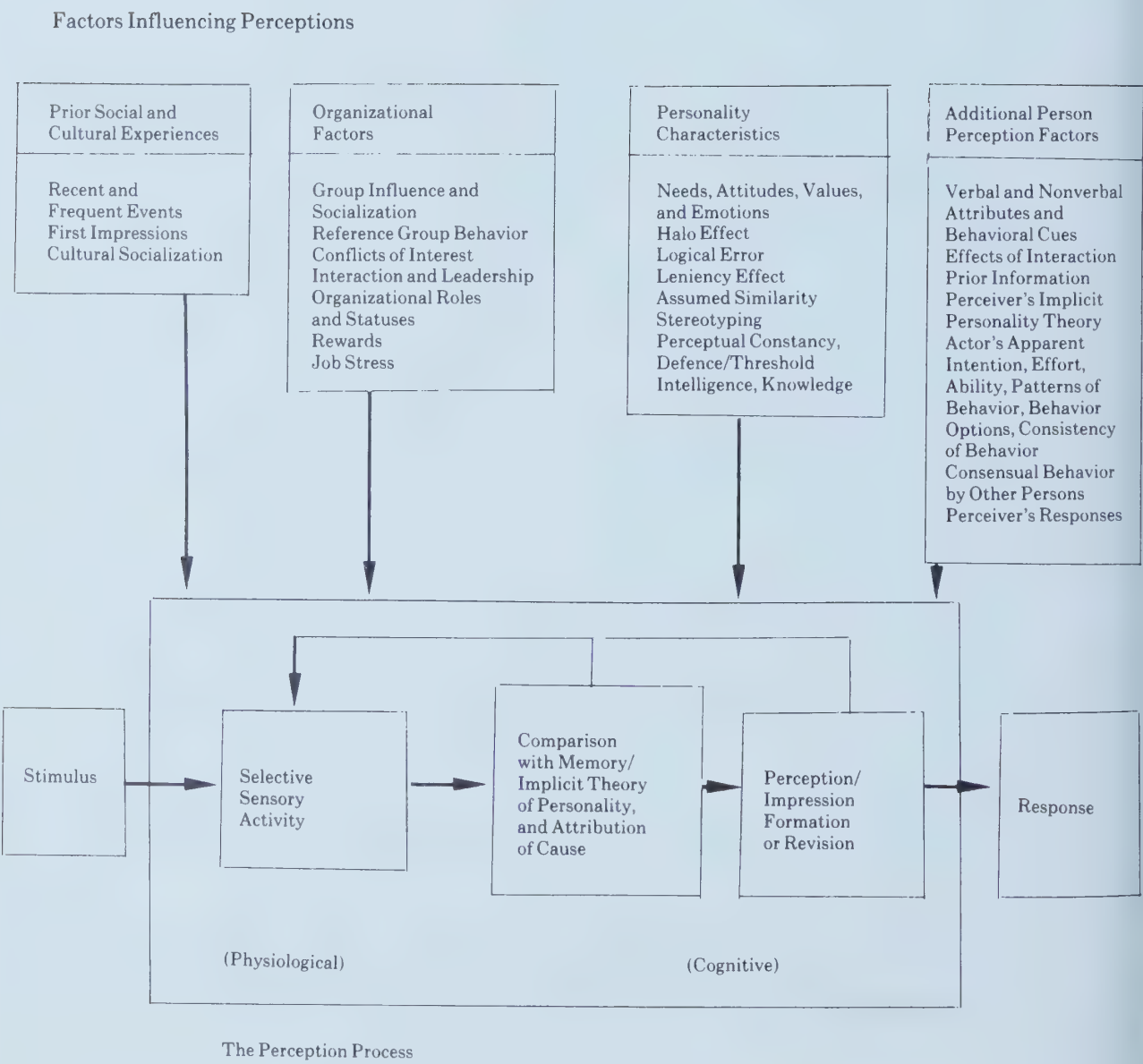


Figure 1: The Perception Process and Influential Factors

categories: (a) influences of social experience and cultural background; (b) impact of the perceiver's values, attitudes, and personality; (c) dynamics of person perception; and (d) perceptions of causality in social events.

Social and Cultural Experience

Social/organizational experience and cultural heritage are widely accepted as important determinants of perceptions. Clement (1978, p. 51), for example, argued that individuals process and categorize environmental occurrences according to existing "perceptual structures"—structures based on prior experience that are expanded and altered by the new perceptions. To Wrightsman (1977, p. 95), these perceptions develop as if "peeling an onion." Though the weighting of new and existing pieces of information is unclear, first impressions and recent and frequent events seem to impose heavily on subsequent impressions—except where perceivers consciously resist their prejudicial influence (Epstein & Rock, 1960; Krech et al., 1982; Litterer, 1973). Common work and other experiences also lead individuals to form similar perceptions (Litterer, 1973) and there is evidence that social contact and familiarity with different classes of persons and situations, group norms, personal self-confidence, and linguistic classificatory labels also affect perceptions (Tajfel, 1969).

Furthermore, perceptions of facial and other perceptual cues seem to be culturally influenced; individuals from different cultures sometimes express emotion differently, so their cues are open to misinterpretation (Brunswik, 1944; Tagiuri, 1969). Of course, the discipline of anthropology also has an extensive literature attesting to the pervasive and powerful effect of culture on individual perceptions and on resultant "appropriate" behavior. According to Murphy (1979, pp. 14, 22-23), the "majority view among social anthropologists" favors substantial cultural determination of individual perceptions and actions. By shaping perceptions, culture "tells us how we should act . . . [and] what we can expect of the other person. Behavior is thus rendered predictable, often within broad limits, and we gain a degree of mastery and confidence in social situations." Likewise, Vivelo (1978, pp. 16-17) saw culture as a "system of rules or a pattern for behavior—a conceptual pattern that individuals use to explain and justify their experiences or events." Again, Geertz (1979, pp. 43, 46-47) proposed culture as "a set of control mechanisms—plans, recipes, rules, instructions" that impose on individual perspectives and behavior. At the same time, Geertz focused attention on culture's diverse effects on individual perceptions and behavior: "Becoming human is becoming individual, and we become individual under the guidance of cultural patterns."

Organizational Factors

Litterer (1973) highlighted certain characteristics of organizational life that affect members' perceptions. Particularly important is organizational socialization: colleagues, superordinates, and subordinates instruct perceivers about physical, financial, personal, and other signals, thereby educating them about prevailing views of reality and encouraging them to behave accordingly. Individuals—particularly those who lack self-confidence or who value social acceptance—are persuaded to accept, or at least appear to accept, the "group consensus," especially in ambiguous social settings. Perceptions are further affected by the nature of organizational interaction, by authoritative or participative leadership, by expected and actual role behavior and statuses, and by rewards for creativity and achievement; and work stress can prompt unduly early and inaccurate impression formation. The "reference groups" individuals use to judge norms of acceptable behavior and to provide bases for comparison

also influence perceptions and behavioral responses. As French et al. (1985) added, groups frequently distort perceptions about opposing groups with competing interests, leading to mutual mistrust, suspicion, power-consciousness, competitive behavior, and misunderstanding of others' intentions.

Personality Characteristics

Many personality variables have emerged as important influences on individuals' social perceptions; beliefs, needs, emotions, attitudes, values, and expectations of perceivers are frequently cited (French et al., 1985; Kelly, 1980; Krech et al., 1982). Central, however, is Tagiuri's (1969) classification of the personality-related "judgmental errors" (Krech et al., 1982, p. 705) identified by Bruner (1951) and other researchers during the 1950s and 1960s: (a) "halo effect," or a tendency to form global impressions based on overall judgments of goodness or badness (such as where a teacher obtains an initially unfavorable impression of a colleague or student and attributes other undesirable characteristics to that person); (b) "logical error," or assumed coexistence of particular traits (where a pupil assumes, say, that a teacher's energy will be accompanied by aggressiveness); (c) "leniency effect," or a tendency to rate persons high on favorable attributes and low on unfavorable ones; and (d) "assumed similarity," where other persons are assumed to have emotions and traits akin to those of the perceiver. Modern writers on perception commonly add a fifth factor: "stereotyping," that is, "a tendency to assign to people many of the characteristics (real and imagined) of the typical member of the group or class to which they are thought to belong" (Krech et al., 1982, p. 705). For this reason, a professor might be classified as absent-minded or a school principal regarded as an expert teacher merely on account of their status.

Other research has explored the intervening nature of personality through four related factors: "perceptual constancy," "perceptual defence," "recognition threshold," and "preperceptual selection." Individuals' stable and consistent perceptual frameworks are shaped and reinforced through heightened awareness and enhanced valuation of prominent and personally relevant events (Bartley, 1980; Kelly, 1974). To help preserve perceptual "balance," perceivers also "intellectualize" about discordant events, shaping them to fit existing understandings (Heider, 1980, p. 10; Litterer, 1973). Indeed, perceptual defences may cause perceivers not merely to amend interpretations of items but to defensively repress contradictory information from conscious recognition. Paradoxically, selection necessitates prior recognition (preperception); as Hochberg (1978, p. 216) explained, "the self we are aware of . . . sees only what the unconscious observer permits him to see." Less absolute than perceptual defences are recognition "thresholds." Perceivers readily identify important and consistent (low threshold) stimuli; incongruent items can also be recognized, but only after blatant or extended exposure.²

Additional personality factors intrude in the formation of perceptions. "Field-independent" persons retain their preconceived mental sets even in the face of new and conflicting evidence: new events all too easily convince "field-dependent" individuals to amend their perceptions (Hamachek, 1970). High intelligence (Kelly, 1974), "cognitive complexity" and maturity (Bieri et al., 1966; Wrightsman, 1977), inferential ability and knowledge of persons or situations (Gage & Cronbach, 1955), emotional adjustment, interests, and fields of specialization and social interaction (Taft, 1955) also affect judgments of people and social events, as do the personalities of stimulus persons, the nature of the judgmental tasks involved (Tagiuri, 1969) and the judgments and behaviors of relevant social groups (Asch, 1960; Deutsch & Gerard, 1960).

Perceptions of Persons

Perceptions of persons and their relationships and behavior are more complex—and often less accurate—than those of inanimate objects and other social events; for person perceptions embody impressions of “intentions, attitudes, emotions, ideas, abilities, purposes, traits, thoughts, perceptions, memories—events that are *inside* the person and strictly psychological” (Tagiuri, 1969, p. 396). Three aspects of “person perception” are important: (a) perceptions of observable behavior and attributes; (b) assignment of attributions to explain behavior; and (c) use of “implicit personality theories” to form impressions.

Perceptions of Observed Behavior and Attributes

Individuals utilize a range of cues and information sources to understand others’ feelings, intentions, and relationships; extrinsic attributes of perceived individuals and the personality types, traits, prejudices, and stereotypes of perceivers themselves are powerful forces (Hochberg, 1978). Facial and physical characteristics of perceived persons provide particularly strong and consistent—but inaccurate—signals about personalities and emotions (Tagiuri, 1969); facial expressions seem to be interpreted similarly even across cultures (Ekman, Sorenson, & Friesen, 1969; Izard, 1971). Posture and position provide cues about both positive and negative attitudes, and averted gaze and abnormal mannerisms such as hesitation and silence create negative impressions of persons (Mehrabian, 1972). The implications of these findings for perceptions of self-conscious pupils, socially inept administrators, and unconventionally attired instructors are clear. Tagiuri (1969) noted that perceptions of persons are further complicated by the influences of the halo effect, logical error, and other factors referred to earlier, by role relationships, status differences, and other contextual variables, and by the differing perceptual skills needed to gain impressions of individuals, groups, and social events. Through “dyadic interplay,” perceivers’ own actions also affect the behavior, and thus perceptions, of those they seek to appraise:

The perceiver . . . has to allow for the fact that he himself . . . is also the object of perception and thought and that, as such, he influences his own object of perception. Observer and observed are simultaneously observed and observer. Their reciprocal feedback processes modify their self-presentation and, in turn, their reciprocal perceptions, in a continuous recycling but varying process during which each person uses the variations in himself and the other person as a means of validating his hypotheses about the other. (Tagiuri, 1969, p. 426)

This quotation reminds us also of the array of “interaction ritual” and “impression management” strategies that we employ daily to influence the perceptions of others in the university, school, or office (Goffman, 1967; Schlenker, 1980).

To deal with all of this complexity, perceivers stereotype groups of persons and social settings; perceptions of faculty members, say, tend to be affected by impressions of outstanding professors—although observers’ confidence in those judgments diminishes with the discovery of intragroup variation. More generally, four “experiential principles” seem to guide most perceptions of behavior and attributes: (a) initial person perceptions are “gut-level,” generally positive or negative feelings that usually are subsequently confirmed; (b) perceivers initially notice and seek explanations for unusual attributes or behaviors; (c) first impressions focus on observed characteristics and behaviors, although perceivers quickly progress to perceptions based on personality traits; and (d) individuals view other persons in terms of generally “unified, organized collection[s] of traits that usually ‘hang together’” (Krech et al., 1982, pp. 699-700).

Rist's (1970) classic study of teachers' expectations and student achievement graphically illustrates the profound educational impact of perceptual influences such as the halo effect and first impressions. Rist observed that a kindergarten teacher's classification of pupils as "fast learners" and "slow learners" was based on five initial "subjectively interpreted attributes and characteristics" of students—physical appearance, body odor, skin color, forthrightness of behavior, and use of language in classroom interaction. Having classified the pupils according to her social class-based "ideal type" of the successful student, the teacher (and soon also the students) treated the two groups differentially—encouraging one and controlling the other—and their performances diverged accordingly. At succeeding grade levels, use of these performance measures helped to reinforce the self-fulfilling prophecy that had arisen out of those initial perceptions.

Attributing Cause to Explain Behavior

According to proponents of "attribution theory," perceivers not only observe and describe persons and their behaviors, but they often seek greater understanding by attempting to determine causes for behaviors (Shaver, 1975). Attribution theory has attracted attention among social psychologists since the 1970s (Hewstone, 1983): educational researchers continue to ignore this avenue for investigating perceptions and behavior among educational policy makers, administrators, educators, and students (Frasher & Frasher, 1981). "An attribution is an inference about why an event occurred or about a person's dispositions" (Harvey & Weary, 1981, p. 6). Wrightsman's (1977, p. 100) illustration is instructive:

People perceive the behavior of others as being caused and . . . they attribute the cause either to the person, to the environment, or to a combination of the two. For example, Joe failed to call me last night. I conclude that either he forgot (called a personal or dispositional attribution) or his car stalled and he couldn't get to a phone (environmental or situational attribution) or he was mad at me but when he got over being mad the phone at his house was tied up (combination of dispositional and situational attributions).

Apparent accidents, involuntary actions, and unintended outcomes usually require no attributions of cause, and adherence to social norms and conventions also explains many recurring behaviors. Unanticipated and seemingly intentional behaviors, however, call for attribution of a personal trait or external cause; the observer thereby acquires an understanding of the actor and/or situation—one that may create a lasting impression about the other individual's disposition and/or about their social circumstances (Krech et al., 1982; Shaver, 1975, 1981).

Heider (1985) identified five main strategies for determining cause: (a) "Trying"—behavior that reflects exertion and a clear intention is usually regarded as personally caused (e.g., an educator who displays considerable expenditure of energy on a worthwhile project is likely to be judged responsible for its success); (b) "Ability"—actors are held responsible if they seem to have the requisite intellectual, physical, or social ability to produce the outcomes observed (e.g., a seemingly talented professor or teacher might be regarded as the cause of high grades in a class); (c) "Unusual" or "low consensus" behavior—surprising occurrences tend to be blamed on the actors involved; (d) "Distinctiveness"—the more frequently a person acts in a recognized way, the more likely the behavior is to be viewed as a personal characteristic (e.g., if an administrator repeatedly praises all staff members for their achievements, observers may view the commendation as indicative of the administrator's flattering or manipulatory disposition: if the administrator praises staff selectively, then an

external factor—the subordinate(s) singled out for approval—is likely to be held responsible); and (e) “Task difficulty”—a highly complex task, or one that is resisted by the social environment, is more likely to be attributed to the actor (Krech et al., 1982; Shaver, 1981). In addition, a perceiver may consider not only the reasons for an observed behavior but alternative behaviors that the actor elected to forego (Jones & Davis, 1965). Behavior that seems unconventional gives the perceiver “high correspondence”—confidence of knowing what unusual personality characteristic caused it. For example, a principal who sharply criticizes district policies at a meeting of school trustees may be confidently presumed to possess strong personal attitudes about those policies. Finally, the perceiver may search for the source of cause-effect “covariation” (Kelley, 1967)—“the causal candidate which is most closely associated historically with the event being explained” (Antaki, 1982, p. 11). Three personal and environmental elements are taken into account: (a) the observer infers personal attributions from “distinctive,” or uncharacteristic, actions; (b) an explanation is derived by examining the degree of “consistency” or variation in behavior across differing circumstances; and (c) “consensual” behavior by other actors indicates to the observer that environmental factors caused the behavior.

Other factors intervene in the attribution process. Socially undesirable acts prompt strong personal attributions, and unfavorable information about behavior amplifies observers’ interest in identifying causes (Wrightsman, 1977). “Personal motives” make certain kinds of observers especially subject to attributional bias: those who believe “people get what they deserve” consistently blame others for their misfortunes; perceivers who anticipate similar fates usually blame circumstances (Shaver, 1981, p. 138). Trained professionals arrive at distinctive attributions for events within their fields of expertise, probably owing to their exclusive knowledge (Frasher & Frasher, 1981). There are also interactive effects among these factors. If parents or administrators expect high-performing or high-ability teachers to succeed, subsequent high attainment is likely to reinforce opinions about the teachers’ high ability whereas failure may be attributed to their lack of effort.

Our attributions often result in erroneous perceptions. Actors are conscious of environmental constraints and circumstances involved in making behavioral choices: observers, however, usually have to speculate about the actors’ “circumstances, history, motives, and experiences,” so they focus on and over-attribute behaviors to personal factors (Jones & Nisbett, 1971, p. 5)—“the fundamental attribution error” (Ross, 1977, p. 183).

We also engage in *self*-attribution to form impressions about ourselves.³ Knowing our own contextual factors, we tend to “blame the environment” (e.g., unsupportive politicians) for our own behavior: observers blame our personal characteristics (e.g., political naiveté, Jones & Nisbett, 1971, p. 2). Moreover, feeling confident that external circumstances are responsible, we rarely seek confirmation of self-attributions (Olson & Ross, 1985). Further self-attribution bias arises out of our explanations of academic, vocational, and social successes and failures: We tend to blame external circumstances for our own failures but see ourselves as instrumental in successes (Shaver, 1981; Wrightsman, 1977)—an “ego-protective” distortion of attributions (Hewstone, 1983, p. 3). In this regard, Rogers (1982, p. 231) reported an observed tendency for classroom teachers to describe pupils as “odd,” “disturbed,” or “peculiar” when explaining their students’ failures. Self-attributions also affect our behavior: attributions to “stable,” or long-lasting, qualities such as ability or hard work motivate future effort; attributions to transient personal factors, such as luck, mood, or fatigue, do not (Weiner, 1979).

In summary, Krech et al. (1982, p. 715) concluded from their review of research that, where perceivers witness pleasurable or undesirable behavior, are affected by behavior, place great importance on behavior, or observe their own behavior, they “are likely to both see and believe what [they] ‘want’ to, and . . . attribute accordingly.” Furthermore, the greater the involvement of perceivers in behavior, the more likely perception bias—and conflict of perceptions—is to arise and the stronger is its probable effect. Despite current criticism of attribution theorists’ reliance on rationality, predictable bias, and human desire to investigate and process social interaction information (Hewstone, 1983; Lalljee & Abelson, 1983), attributional principles have substantial relevance for educational settings: They signal a need for open communication within faculties, staffrooms, and classrooms and help in understanding educators’ and stakeholders’ explanations for organizational and personal successes, failures, and behavior. And as Frasher and Frasher’s (1981) novel framework indicates, attribution theory also holds important insights for educational researchers.

Implicit Personality Theories

Although observations and attributions help in the development of perceptions, the perceiver finally relies on a “set of expectations about which personality traits will be mutually associated” to form organized impressions about others (Shaver, 1981, p. 139). Two principles of perception are involved: (a) despite the incompleteness of available and observed data, the perceiver develops consistent perceptions (“forms impressions”) of other persons by identifying and stressing certain perceived attributes and inventing others to complete the picture; and (b) the major determinant of impressions of persons is not external stimuli but each perceiver’s personal, unstated (“implicit”) theory about the traits associated with different personality types (Krech et al., 1982). The perceiver categorizes other persons primarily according to physical characteristics, temperament, intelligence, and socioeconomic standing; other attributes that are assumed to follow are conferred accordingly. The perceiver also classifies each attribute on the dimensions of goodness-badness, strength-weakness, and activity-passivity (Osgood, Suci, & Tannenbaum, 1957). Consequently, on the basis of observed behavior, the perceiver can both form a unified impression about the actor and rate that person on each of the three dimensions.

In a study of sales teams in the communications industry, Gladstein (1984) found implicit theories of leadership traits to be important in the formation of impressions among team members. Furthermore, Gladstein’s “most striking finding” was that these theories had led individuals to erroneous perceptions of coworkers’ personalities and, hence, to unfounded explanations of their successes or failures. Similarly, in an educational context, a junior postsecondary instructor might confer on a colleague of high status the traits of coldness and insincerity. The worker may believe that these traits are not only consistent with high status but indicative of, say, relative badness, extreme strength of personality, and high activity. Despite the instructor’s scant knowledge of that colleague, an impression is formed—one that is likely to be not only partially unfounded but subject to observational error based on first impressions, attribution biases, and so on. In this way, implicit personality theory highlights the important role of educators’ predetermined beliefs about personality in the formation of impressions of persons, as well as the constructed unity of those impressions.

Implications for Education

Research on perception highlights the powerful, unavoidable impact of personal perspectives on all activities—including educational practice and scholarly endeavor. The following seven generalizations highlight for educators, administrators, researchers, and readers of research reports central aspects of that impact.

1. The perception process comprises a number of stages: stimulus, sensation, comparison with an implicit theory of personality and existing perceptual knowledge, attribution of cause for personal behavior, and impression formation/amendment.
2. Perceptions, rather than objective reality, at least partially shape individual attitudes and behavior.
3. Perceptions are frequently no more than approximations of reality.
4. Individuals are incapable of recognizing and verbalizing some perceptions.
5. Perceptions tend to develop as internally consistent and temporally stable structures.
6. Perceptions are affected substantially by an extensive but recurring array of factors arising out of social and cultural experiences, organizational attributes, and personality characteristics.
7. Additional factors, such as first and recent impressions, impose on perceptions of persons.

Implications for Practitioners

Such knowledge of perception may be seen by some policy makers, administrators, or other practitioners as “a tool to predict and control human behavior” (Hochberg, 1978, p. 213). For example, by manipulating organizational structures, social relationships, and events, and by displaying appropriate personality characteristics and communicating suitable information, administrators may attempt to shape the perceptions and resultant behavior of subordinates, sponsors, and other stakeholders. Litterer (1973) and Bosetti (1973) defended this use of “administrative apparatus” to integrate discrepant perceptions and efforts in schools and other organizations. Bosetti also saw a place for administrative intervention to relieve dysfunctional stress and its symptom, rapid perceptual closure.

Alternatively, educators and others may utilize their knowledge of perception theory more personally to improve their perceptual skills and interactive behavior in order to approach their daily tasks and social interaction more fully and more accurately informed. Initially, they need to be aware of the factors that distort impressions of people and bias judgments of events. For example, perception theory informs us that the quality of educational evaluations and decisions about personnel and other matters may be enhanced if perceivers resist perceptual influences such as the halo effect, logical error, and assumed similarity. By admitting and weighing evidence that contradicts existing images of persons or events, overall perceptions can be tested, revised, and refined. The principles of implicit personality theory and attribution theory also highlight the prevalence and sources of differing and inaccurate perceptions; they remind practitioners of the importance of frank, regular, organization-wide communication and of the need to watch for bias in their own and others’ causal explanations of organizational performance, individual action, and conflict. Particular attention should be paid to the reasons they use to justify their own behavior, attitudes, plans, achievements, and failures, and they need to bear in mind their potential as observers for erroneously holding others fully accountable for their behavior. The foregoing generalizations and discussion highlight other important factors for which

professors, teachers, and administrators need to be alert.

Beyond awareness, practitioners can act directly to improve the quality of their perceptions—and, therefore, the appropriateness of their behavior—in educational contexts. First, resisting undue influence from initial and recent impressions, educators can consciously and systematically consider issues, persons, and events from a variety of standpoints. In this regard, Morgan's (1986) advice for sound organizational management can inform educational personnel. Morgan argued that effective professionals possess a capacity to "read social situations," whereby they intentionally

remain open and flexible, suspending immediate judgments whenever possible, until a more comprehensive view of the situation emerges. They are aware of the fact that new insights often arise as one reads a situation from "new angles," and that a wide and varied reading can create a wide and varied range of action possibilities. (p. 12)

Indeed, Morgan's elaboration of disparate metaphorical images for viewing organizations affords a framework of multiple, divergent perspectives that administrators and others may find helpful in their effort to view events and persons in diverse ways.

Second, educators need to test their perceptions against those of colleagues, students, administrators, and stakeholders with whom they associate; this calls for a concerted strategy of frank, nonjudgmental communication in the school, university, or boardroom setting, with regular invitations to others to express support or present contrary perspectives. As an example, Kurmeyer (1986, pp. 3-4) commented that school-level evaluators who "actively solicit the perceptions of those whom they are evaluating" can improve understanding, communication, and the quality of evaluations, and can relieve teachers' work stress and feelings of anxiety about supervision.

Third, practitioners need to make critical thinking a feature of their professional work lives. Even more than other professionals, educators are susceptible to the confining socialization of schooling, teacher education programs, and practicum, internship, and initial teaching experiences (Lanier & Little, 1986; Patterson & Miklos, in press; Tardif, 1985; Warren, 1985) that imprisons fledgling professionals within conventional views of education and teaching and discourages analysis and critical reflection. Strategies for fostering critical reflection in education faculties and schools have been proposed elsewhere (Johnson, 1987). It is sufficient to note here that academics, policy makers, teachers, and administrators must bear individual responsibilities for exposing, discussing with colleagues, and habitually questioning existing educational values and theories and the instructional practices to which they subscribe.

Implications for Researchers

Perceptions also impose on educational inquiry in two critical ways. First, researchers draw heavily on the perceptions of individuals associated with educational organizations to learn about life in those contexts, searching either for proxy measures of an objective reality or for expressions of disparate realities for individuals. In either respect, perceptions have much to reveal about meaning and behavior in educational situations. At the same time, the perceptions gained from selected informants afford only partial views of the reality perceived by participants—perceptions prejudiced by all the prior social and cultural experiences, organizational factors, personality characteristics, and other factors that bias and otherwise shape individuals' expressed attitudes and behaviors in diverse, immeasurable ways.

Second—less obvious, but equally important—is the impact of perceptions on researchers themselves. Researchers' own perceptions shape their theories about life in educational organizations, prompt them to identify and regard certain kinds of activities and ideas as worthy of study, bias their selections among available methodological techniques, and influence the data they collect from educators and other

stakeholders. In the first place, paradigmatic stances direct and limit researchers' foci of inquiry; writers such as Burrell and Morgan (1979), Owens (1982), and (in the current volume of *The Alberta Journal of Educational Research*) Jacknicke and Rowell (1987) have made this abundantly clear. One researcher, for example, may approach the study of a school or higher education setting from the standpoint of a traditional "rationalistic paradigm" or "empirical-analytic inquiry orientation." As Jacknicke and Rowell (1987) explained, "The researcher within this orientation sees a classroom existing as a set of variables, and . . . attempts to explain and predict behaviors in terms of these variables" (p. 65). A second researcher, adhering to an "interpretive" or "naturalistic" orientation, may investigate the same social situation expecting to find socially constructed, multiple realities. This researcher may accept what Owens (1982) labeled the "naturalistic-ecological hypothesis which claims that human behavior is so significantly influenced by the context in which it occurs that regularities in those contexts are often more powerful in shaping behavior than differences among the individuals present" (p. 5); or the researcher may emphasize individuality, believing that "What is true for one person is not for another. In that sense we live in different worlds" (Greenfield, 1982, p. 5). In either case, the second researcher will see realities as multiple and context-bound and will be concerned, as Jacknicke and Rowell (1987) observed, to "make explicit the expectations, attitudes, motives, and common meanings that teachers and students have in specific situations" (p. 67). A third researcher, subscribing to a "psychic prison" (Morgan, 1986), "critical theory" (Bates, 1986), or other "radical humanist" (Burrell & Morgan, 1979) orientation, may be led to explore the social metaphors and assumptions that individuals use to dominate others, express their interests, and otherwise cope in the social setting of concern. Jacknicke and Rowell (1987) noted that, with this guiding orientation, "concerns relating to epistemology, power relationships, root metaphors, politics of schooling, and other factors that interplay to construct that phenomenon we know as education need to be examined and exposed" (p. 68). Clearly, the three researchers' orientations will direct them toward different issues and divergent explanations of circumstances and events. More than this, through their emphases on and enhanced responsiveness to specific dimensions and views of organizational life, their limited foci are attended by a potential for misconstruing actions and expressions of opinion accordingly. Morgan's (1986, p. 197) discussion of the political metaphor stressed this potential for a chosen orientation to bias the perceptions of an observer: "Under the influence of a political mode of understanding everything becomes political. The analysis of interests, conflicts, and power easily gives rise to a Machiavellian interpretation that suggests that everyone is trying to outwit and outmaneuver everyone else."⁴ Again, a radical humanist perspective might lead a researcher to perceive erroneously that an individual's action or statement is fundamentally an expression of domination; conversely, to ignore this perspective may also be to overlook an important explanation for that behavior or expression of opinion.

Also critical for the quality of research is the inescapable influence of every researcher's perceptions on the processes of data collection, analysis and interpretation, and subsequent reporting of results. Initially, research methodologies are frequently dictated not only by extant knowledge and needs for further study in particular areas, but also by the preferences, interests, and self-perceived capacities of individual researchers. For those who pursue quantitative studies, data collection is subject to researchers' prior judgments about aspects of phenomena that are worthy of attention. These judgments influence the design and wording of questionnaire

items and the construction of interview schedules and management of interviews. Thereby, researchers' perceptions limit the range of subsequent responses. Perceptual biases also impose on analyses of those data, including selections among available statistical and other techniques, and on the arrangement and reporting of findings. For policy analysts, perceptions direct the selection of respondents, identification of focal issues, choices among available documentary sources as well as the relative weightings and meanings assigned to various stakeholder's expressions of opinion. Other researchers, trying to minimize the confining influences of existing theoretical knowledge and personal belief, prefer to produce detailed descriptions of events, statements, and other observations in specific contexts and to allow these raw data to direct the development of theoretical frameworks for understanding life in those contexts. Even so, few would deny that the favored research perspectives of these central research "instruments" (the researchers), their selective perceptions and explorations of events, and their heightened awareness of and identification with particular informants and viewpoints all vitally affect data collection as well as subsequent efforts to ascribe meaning and significance and to extract themes from voluminous, often conflicting, data.

What can researchers do to overcome—or at least minimize—the threat of prejudice arising from reliance on their own and others' perceptions? Initially, it should be admitted that perceptions, as powerful, pervasive guides to social behavior, are valuable objects of scholarly attention. Moreover, the first issue—informants' perceptions—is of less concern to researchers who subscribe to a strictly individual conception of reality for every respondent and informant; diverse perceptions are seen as indicative of diverse realities. Even so, these researchers must have regard for the faithfulness of the perceptions obtained. The concern remains central, however, for the majority of educational researchers, each of whom searches either for an objective reality or for a realistic account of a shared reality for inhabitants of a chosen educational setting. The trustworthiness of perceptions acquired by researchers can be actively addressed in two ways. First, researchers are better prepared to deal with perceptual bias and associated difficulties if they are conversant with and watchful for the factors (discussed above) that impose heavily on informants' perceptions and, thus, upon the quality of data acquired. Second, naturalistic researchers in education and scholars in other disciplines have devised useful strategies for enhancing and establishing the trustworthiness of perceptual data; these are worthy of consideration by all who engage in research with informants and respondents. (These strategies are noted in subsequent discussion.)

The constraint caused by factors influencing researchers' own perceptions is more subtle and, hence, more difficult to manage, yet it remains a critical constraint on the quality of all educational research. This potential for perceptions to shape—or, more disturbing, to misshape—outcomes of educational research is clear. Here again researchers bear dual responsibilities—the first involving perceptual *self*-awareness. Researchers need to acquaint themselves with the factors that influence perceptions and should commit themselves to introspection and frank appraisal and disclosure of their own research orientations, methodological biases, and inherent prejudices relating to the persons, organizations, and issues associated with each research effort. Only then may we expect researchers to be equipped to investigate and report accurately on influences that focus and restrict the outcomes they present. These proposals warrant brief elaboration.

First, researchers need to consider the powerful and deleterious influences of first impressions and personal preconceptions and assumptions. As with practitioners,

they need to avoid hasty assessments and instead should view social situations, individuals, and their own research efforts expansively. Second, researchers can enhance the quality of their work by expending effort to reflect critically on, acknowledge, and, as far as possible, accommodate opposing conceptions of reality in their studies. Ideally, the confining and potentially misleading influences of particular research orientations may best be avoided by accommodating multiple perspectives within individual research initiatives. Of course, such effort to furnish readers with a range of viewpoints leads to divergent, at times competing, interpretations, explanations, and conclusions—conclusions that, as Jacknicke and Rowell (1987) observed, may be difficult to reconcile. Moreover, this approach is frequently infeasible, given time and resource constraints. At the very least, then, scholars have an obligation to reflect on and admit the limitations that chosen research orientations impose on their investigations and resultant presentations of findings. Readers of their research reports can thereby be afforded some knowledge of the nature and extent of, and biases inherent in, those contributions to knowledge. Third, each researcher should endeavor to select and employ methodological techniques most suited to the research problems identified. The temptation to accede to personal preference must be strenuously resisted, and so the need for dispassionate review of choices is vital. Fourth, each researcher should consciously and as “objectively” as possible (having regard for the perceptual influences noted earlier) subject to personal review all personal beliefs, prior conceptions, and other known biases that relate to the educational issues under investigation. Subsequently, wherever possible, these matters should be exposed to public scrutiny in final research reports. As Dimen-Schein (1977, pp. 13-14) entreated anthropologists: “We always begin [research] with preconceptions. . . . Such preconceptions organize our perceptions. . . . We must therefore make them explicit, and we must state and explain the reasons for them.” Only in this way can readers judge the trustworthiness of researchers’ investigative decisions and the scholarship of their contributions.

Strategies also exist to deal directly with the potentially prejudicial power of perceptions—of informants *and* researchers—on the trustworthiness of research outcomes. They have been explicated in detail in the literature and need only be mentioned here. Nevertheless, the centrality of perceptions and likelihood of perceptual nonrepresentativeness and bias in educational endeavor highlight their relevance for all research initiatives. Educational writers (e.g., Bogdan & Biklen, 1982; LeCompte & Goetz, 1982; Lincoln & Guba, 1985; Merriam, 1985; Miles & Huberman, 1985; Owens, 1982; Skrtic, 1985), primarily those of a naturalistic bent, have advocated strategies to enhance the truth value, applicability, consistency, and neutrality of research. They include triangulation, member checks, repeated/protracted observations in natural settings, and disciplined introspection (to establish “credibility”/internal validity), purposive sampling and thick descriptions (for the sake of “transferability”/external validity), and auditable disclosure and independent audit both of the research procedures (“dependability”/reliability) and of interpretations by researchers (“conformability”/objectivity). These strategies may serve different ends for different researchers. For example, as Silverman (1985) observed, Denzin’s (1970, p. 472) defence of triangulation as a device for corroborating or “adjudicating between accounts” to minimize bias and promote validity involves a use of this strategy for a positivistic intent. At the same time, by adopting an interpretive orientation, collection of multiple perspectives can provide a range of individual constructions of circumstances and events and draw attention to possible sources of perceptual disparity. In view of the factors that affect individual perceptions in diverse ways, current perception theory lends

support to inclusion of these strategies, where appropriate, in both kinds of research.

Educational researchers also have much to gain from other cautions considered and techniques deployed by field research colleagues in anthropology and sociology. Not only do ethnographers and participant observers draw on a wide range of cross-validating strategies, but they adapt methodological strategies and recheck their developing interpretations as research needs demand (Wolcott, 1982, 1985; Van Maanen, 1979). As Wax (1971, p. 10) remarked, researchers who find themselves constrained by "method, theory, or technique" need to "slip through the bars and try to find out what is really going on"—methodological creativity and versatility are emphasized. Anthropologists are also particularly conscious of the limiting and distorting power of their own culturally created values, beliefs, preconceptions, and understandings of reality, and organizing categories. To acquire emic understandings of inhabitants' experience, they strive to "place in parentheses" those personal perspectives and "to always doubt the relevance of spontaneous moments of recognition" that may spring from their own prior conceptions or misconceptions (McDonnell, 1979, p. 28). Indeed, prior conceptions are widely recognized as a blinding influence in educational and other familiar settings (Wolcott, 1985)—one that Spindler and Spindler (1982) found could be remedied only with extended time in the setting. As an additional strategy, field researchers' notes record both direct accounts of informants' perceptions and behavior and—separately—their own reflections and interpretations (Pelto, 1970; Spradley, 1979), helping to minimize the impact of the researchers' perceptions on their developing understandings and subsequent thick descriptions. Personal diaries further allow field researchers to document and explore the influence of their own perceptions on the direction and conduct of inquiry throughout the course of their investigations.

Conclusion

The pursuit of an adequate theory of perception is far from complete. Nevertheless, research effort is now being directed toward explanation of individuals' causal attributions in educational and other settings, and researchers are seeking further understanding of the significance and frequency of influence of various factors that intervene in the perceptual process. There remains a need for extensive study of the nature of perception, important factors, and extent of individual differences in perceptions in educational settings. Exploration of these avenues should provide greater insight than is now available on life in educational organizations. In the meantime, researchers who rely on their own and others' perceptions for advancing knowledge about aspects of education need to be conscious of the factors that affect those perceptions, and they have an obligation to remind readers that their findings portray reality only as it is viewed by themselves and their chosen informants. At the same time, there is consolation in the knowledge that perceptions, rather than objective reality, direct most attitudes and responses. Hence understanding of social behavior in educational settings may continue to be advanced, provided that researchers recognize and acknowledge their individual research perspectives, personal preconceptions, and preferences, and utilize appropriate research strategies to maintain trustworthiness in their inquiry.

Notes

1. There are two opposing schools of thought on the question of process. Adherents of the traditional, indirect perception approach contend that stimuli become meaningful only through a sequence of cognitive activities. Heil (1983), for example, distinguished sensory activity from the perceptual task of isolating specific features of stimuli and developing inferences or beliefs from these features, and he highlighted the latter as a subsequent, cognitive activity. On the other hand, Gibson's (1979) "ecological view" of "direct perception," defended by Michaels and Carello (1981, p. 157) and others, rejects the "impoverished input" theory and the frames of reference view of perceptual organization. They argue instead that perceivers are "active explorer[s] of the environment" seeking out meaningful information which informs them directly without a need for internal processing by perceivers; individuals admit meaningful stimuli selectively, and these trigger perceptions directly.
2. Limitations of these theoretical concepts should be acknowledged. To Neisser (1976), the selection of stimuli for perceptual processing may be a positive, rather than negative, filtering process; rather than using perceptual defences to discard items, individuals may actively choose desirable events from among those available. Furthermore, while much of the literature affords support for the concepts of constancy and threshold, Forgus and Melamed (1976) advanced rival explanations for the research findings on which these notions were founded, and Hochberg (1978) concluded from conflicting research reports that the concept of threshold in social perception is both arbitrarily defined and empirically tenuous.
3. The self-attributional process is widely thought to operate in the same general way as for other persons, although Farr and Anderson (1983) disagreed with this view.
4. Morgan's (1986) use of the dramatic "psychic prisons" metaphor also reminds us of the power of language tools, vocabulary, and communication skills to shape perceptions.

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Reflections

Educational systems in industrialized nations are being confronted, often simultaneously, with four kinds of *scarcity*: scarcity of resources, scarcity of students, scarcity of authority and influence, and scarcity of public confidence. Emerging evidence suggests that this condition will be a *long-term* one which requires *different* responses from those to which conditions of growth have habituated us.

The challenge of scarcity to educators is to view it as an opportunity for renewal at every level of operation from classroom to council chamber, and in every sector from early childhood through adult education. For scarcity creates the need for change—to clarify purposes and to determine what to keep doing, what to do differently, what to stop doing, what to start doing. Momentum is generated for reforms that would otherwise be impossible to implement. The outcome can be a more coherent match between purposes, programs and resources; so that the resources support the programs, the programs achieve the purposes, and the purposes mobilize the resources.

This process of renewal highlights the importance of gaining and using better knowledge about what policies and practices help to achieve the desired, frequently competing, objectives of effectiveness, efficiency and equity. And bettering knowledge is what research is all about. In a time of growth, however, the impact of research was not immediate or direct. Will its impact be any different in a time of scarcity? Perhaps.

Perhaps ... if research addresses the pervasive scarcity-inspired issues of the day with a view to sharpening perceptions, stimulating discussion and encouraging questioning. Among these issues are: rethinking the purposes of schooling and education, assessing the meaning and measures of performance for individuals, programs and organizations; examining the rationale underlying current policies and practices; identifying emerging needs and responses to them.

Perhaps ... if research also enhances the "know-how" of practitioners and policy-makers. For both groups, the use of research is optional and their major motivation is to be successful. They will use research when it helps them understand and cope with their scarcity-related problems. Fortunately, our relatively new-found skills in evaluation research, naturalistic methods and policy studies put us in a stronger position than in the past to gain and offer insights and information about such context-specific concerns.

Perhaps the gap between research and practice in education, and between research and policy, can be closed—at least a little. Scarcity gives us a good opportunity to try. The extent of our success will probably be reflected in the support accorded research in the future.

T.O. Maguire

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Educational Problems Revisited

In looking over the back issues of *AJER*, I was struck by the wide variety of topics covered in the papers. There is almost a sense that each generation of scholars has to revisit the central problems of education, and that there is very little memory in the system.

There are several reasons why George Buck's article "M.E. LaZerte: Pioneer educational innovator" is my choice. First, LaZerte was not only an educational innovator, he was a leading educational researcher. He and those who followed him were great believers in the idea that educational innovations of all sorts should be put to empirical test, that educational practice can be improved by carefully designed research, and that the onus is on the innovator to demonstrate the efficacy of an innovation. Beginning researchers could learn much about the merits of creativity, planning, and skepticism by following the path of LaZerte.

The second reason for choosing this article is the hope that it will remind people that we have a significant research heritage. Here was a person concerned with provincial educational matters who actually was a world-class educational scholar. I suspect that were his roots in mid-America, LaZerte would have had the recognition of Thorndike or Pressey.

Finally, when I first read the article, I was impressed by its careful scholarship and clear writing style. Recent rereading has given me no reason to change my mind. Indeed these are characteristics of all of George Buck's work. It was my hope that this article would be an example for other educational researchers. It was certainly in LaZerte tradition.

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M.E. LaZerte: Pioneer Educational Innovator

M.E. LaZerte was a prominent educator in Alberta during the first half of this century. This article describes LaZerte's learning theories and several instructional devices he created and tested. Their merits and weaknesses are discussed from LaZerte's viewpoint, as well as their relationship to general instructional theory and pedagogy. The article also compares LaZerte's innovations and learning theories to other contributors, including those of the prominent American psychologist B.F. Skinner. LaZerte's findings from his instructional devices may have relevance in assessing the efficacy of microcomputers used for instruction.

It has been over 35 years since Milton Ezra LaZerte (1885-1975) held an official position in the University of Alberta. Why should his name be remembered and why should anyone still consider the merits and the findings of his research? Although LaZerte began his career in education in rural Alberta, he did not conform to the common yet erroneous notion that most rural teachers, especially those in Western Canada, possessed pedagogical skills inferior to those of teachers in the large centers of central and eastern Canada and the United States. He not only excelled as a teacher, he also demonstrated his skills in both educational innovation and administration early in his career (Chalmers, 1978).

LaZerte was the first director of the School of Education at the University of Alberta during the 1930s, and he later became the first Dean of that university's Faculty of Education; this was the first faculty in any provincial Canadian university that prepared all teachers for that province (Johns, 1981, pp. 192-193). Immediately following World War I and well before obtaining responsible administrative positions, LaZerte addressed the problems encountered by many teachers attempting to teach difficult concepts to large and often ungraded classes. A believer in scientific research methods as well as innovative experimentation, LaZerte realized that many of the problems experienced by teachers as well as students might be alleviated in part by instructional materials designed to be used by an individual student without constant supervision (LaZerte, 1922, p. 30). It is significant to note that LaZerte began his work in this area several years before the so-called "progressive" movement took root in North American education (Charyk, 1974, pp. 277-278; LaZerte, 1945, p. 12). As early as 1922, LaZerte noted a need for such instructional materials:

There is little apparatus in our schools to assist the teacher in giving a practical setting to the work that covers the field from group counting in primary years to the development of the angle-sum theorem in grade VIII geometry. (p. 30)

During the past 30 years, many individuals and groups from various disciplines, particularly outside education, have attempted either to “improve” or to “save” North American education by means of various teaching and testing machines. Certain American psychologists made the claim in the mid-1950s that no educators had even considered, much less experimented with, automated teaching (Skinner, 1954). Clearly they were unaware of the work and publications of LaZerte. The behaviorist B.F. Skinner developed what he called “teaching machines” that he felt would release individual teachers from boring and onerous tasks and enable them to spend their time doing more important duties. Skinner also claimed that his devices produced a significantly higher level of achievement among his students at Harvard University (Skinner, 1983, pp. 139-140). He could not understand most educators’ reluctance to commit themselves to the use of either his machines or other teaching machines (Skinner, 1984). Another psychologist, Sidney L. Pressey, claimed that he had invented the first teaching machines during the early 1920s and that no interest was shown in them by educators, even though, as he argued, they provided “great savings in material and labor” (Pressey, 1932, pp. 671-672).

For a brief period during the 1960s, interest in teaching machines seemed to wax among many educators. Consequently, several companies designed and produced a variety of devices (Hendershot, 1964). In practice, however, teaching machines did not achieve the goals which Skinner had imagined, nor did such machines see widespread use, especially in Canada (Rutherford, 1961). No one at that time seemed to know that M.E. LaZerte had experimented with and rejected the use of auto-instructional devices of his own design, using primary and secondary school children as his experimental subjects, at least 30 years before Skinner came on the scene to promote an interest in teaching machines (Charyk, 1974, pp. 277-278; LaZerte, 1933, p. 5). If LaZerte actually tried out teaching devices, what were his systems and the machines themselves like? Why was no attempt made to have them mass-produced and used in the schools in order to improve pedagogy and student learning? And how are they relevant to our age of microcomputers? The answers to these questions can be found by studying LaZerte’s experiments and the machines themselves, by considering his findings, and by taking into account the mood and educational environment of the time.

Background

LaZerte received a B.Educ. degree (a graduate degree of the time, similar to the contemporary Master of Education degree) from the University of Alberta in 1926. His thesis, *A Study of the Methods Used by Elementary School Pupils in Solving Problems in Arithmetic*, contains some interesting conclusions related to learning theory. LaZerte (1926) stated that, “the ability of pupils to find correct answers to problems in arithmetic is a poor measure of their actual problem-solving ability” (p. 102). He also found that

“much problem-solving is but a slavish adherence to type methods of procedure which become associated with certain language and number situations that exist in the presented problem” (LaZerte, 1926, p. 102). He took the findings as indications that the pedagogical methods employed by many teachers were unsatisfactory because the action of ascertaining a correct answer to a mathematical problem does not indicate to the teacher whether the underlying problem-solving strategy or concept has been either learned or understood by the student. These findings were, of course, not new. The Roman orator and educator, Marcus Fabius Quintilianus, known as Quintilian, had made the same observations as early as the first century A.D. (Quintilian, 1. 1. 24-25). It is also possible that similar observations were made by others prior to Quintilian. The common findings of Quintilian and LaZerte indicate that many educators are conservative; they believe that “traditional” methods, no matter how demonstrably inappropriate and inferior, are not to be displaced by newer ones. Both LaZerte and Quintilian also concluded that repetitive instruction such as drill and practice and plain memorization do not provide the student with an adequate facility for problem solving. This conclusion is still valid, especially in the criticism of modern “task analyses” (LaZerte, 1933, pp. 3-4; Quintilian, 10. 2. 2-5). It is of interest to note that Quintilian’s and LaZerte’s beliefs are diametrically opposed to those of Pressey and Skinner. Both of them advocated a behavioristic approach to learning, one in which the notion of the individual student formulating concepts about the subject matter being taught is dismissed as nonsense (Skinner, 1954). Although LaZerte acknowledged that his findings were based on a limited sample, he intended to investigate the matter further (LaZerte, 1926).

LaZerte worked on his Ph.D. at the University of Chicago under Charles H. Judd, a contemporary of Edward L. Thorndike. LaZerte’s dissertation *A Diagnosis of Difficulties Encountered in Solving Problems in Arithmetic*, which built on his work for his B.Educ. thesis, was completed in 1927. Judd, unlike the behaviorists, shared LaZerte’s belief that it was necessary for a student to develop a concept of what was being taught, rather than simply being able to parrot it. Judd stated that, “while formal drill gives a superficial mastery of arithmetic processes, it fails utterly to give pupils that higher training in reasoning which might be derived from an effort to understand the meaning of number operations” (LaZerte, 1933, p. x). LaZerte endeavored to devise methods and apparatus, not only to evaluate students’ understanding of problem-solving processes, but also to develop devices that could instruct logical problem-solving procedures so that a student might develop an understanding of the underlying concepts.

Early Innovations

Envelope Test

One of LaZerte’s first methods for assessing pupils’ knowledge of problem-solving procedures was the Envelope Test (LaZerte, 1933, p. 12). The subject was presented with a large envelope on which was typed a question. Two smaller envelopes, located inside, each had a different problem-solving

procedure typed on the outside. The subject was to select only one of the envelopes, the one that was believed to display the correct procedure. This in turn contained two more envelopes with further steps. After further selection, the student would be left with one envelope, inside of which was a card. The card contained the last step of the problem on one side and a message on the other. Only one of the cards in the envelope array stated “This is the correct card”; the others stated, “You are wrong. Go back to the beginning and try again” (LaZerte, 1933, pp. 12-13). Figure 1 illustrates the hierarchical nature of the envelope test.

LaZerte noted that the number of both cards and envelopes was altered to accommodate questions of different complexity. In addition, he stated that some sequences possessed intermediate blank cards or envelopes which indicated that the examinee was on the wrong track. This modification was intended to save time, serving to inform the student of an erroneous choice early in the procedure. Although a blank card or envelope informed the examinee that an error had been made, it did not provide any corrective hint or cue (LaZerte, 1933, p. 13). In this manner, the Envelope Test did not instruct the examinee, and the procedure tested only what the examinee knew at the time of the test. The Envelope Test possessed the capability, nevertheless, of providing instruction in problem-solving strategy, if it was desired. LaZerte had created a rudimentary branching program anticipating those found in many “scrambled books” or programmed texts produced 25 years later (Lumsdaine & Glaser, 1960).

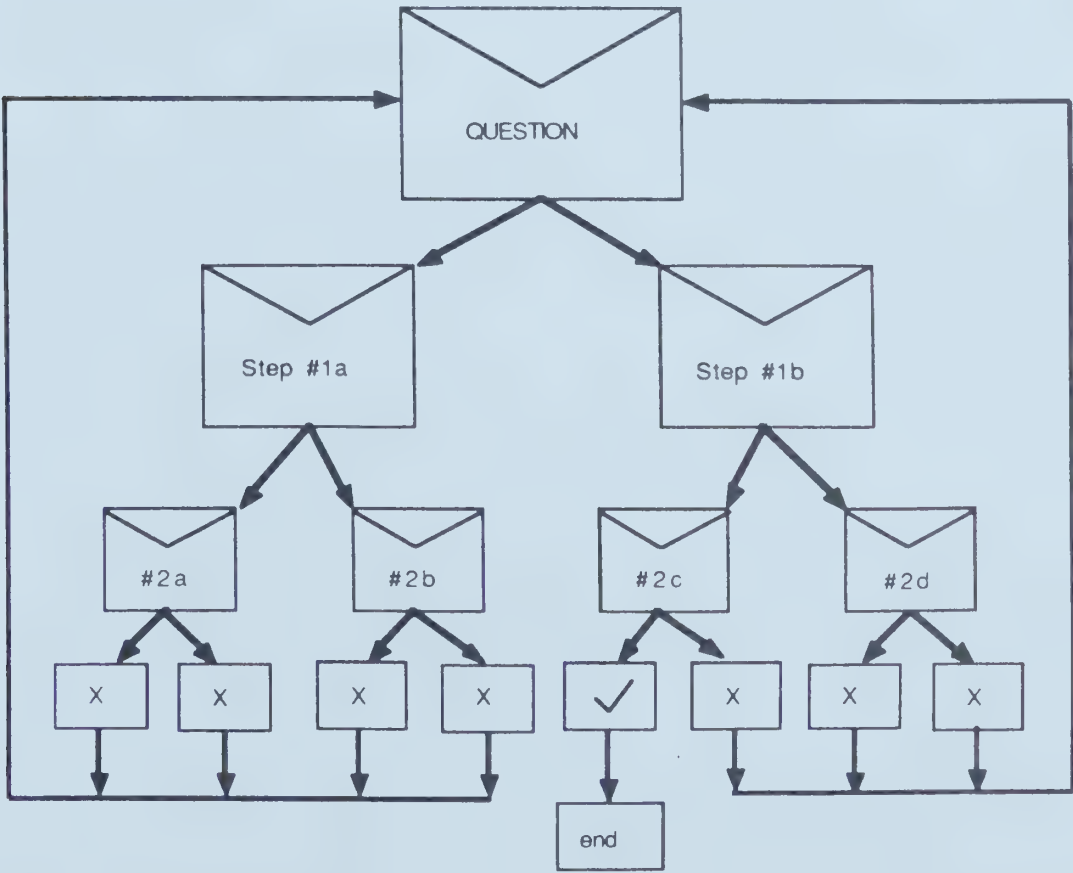


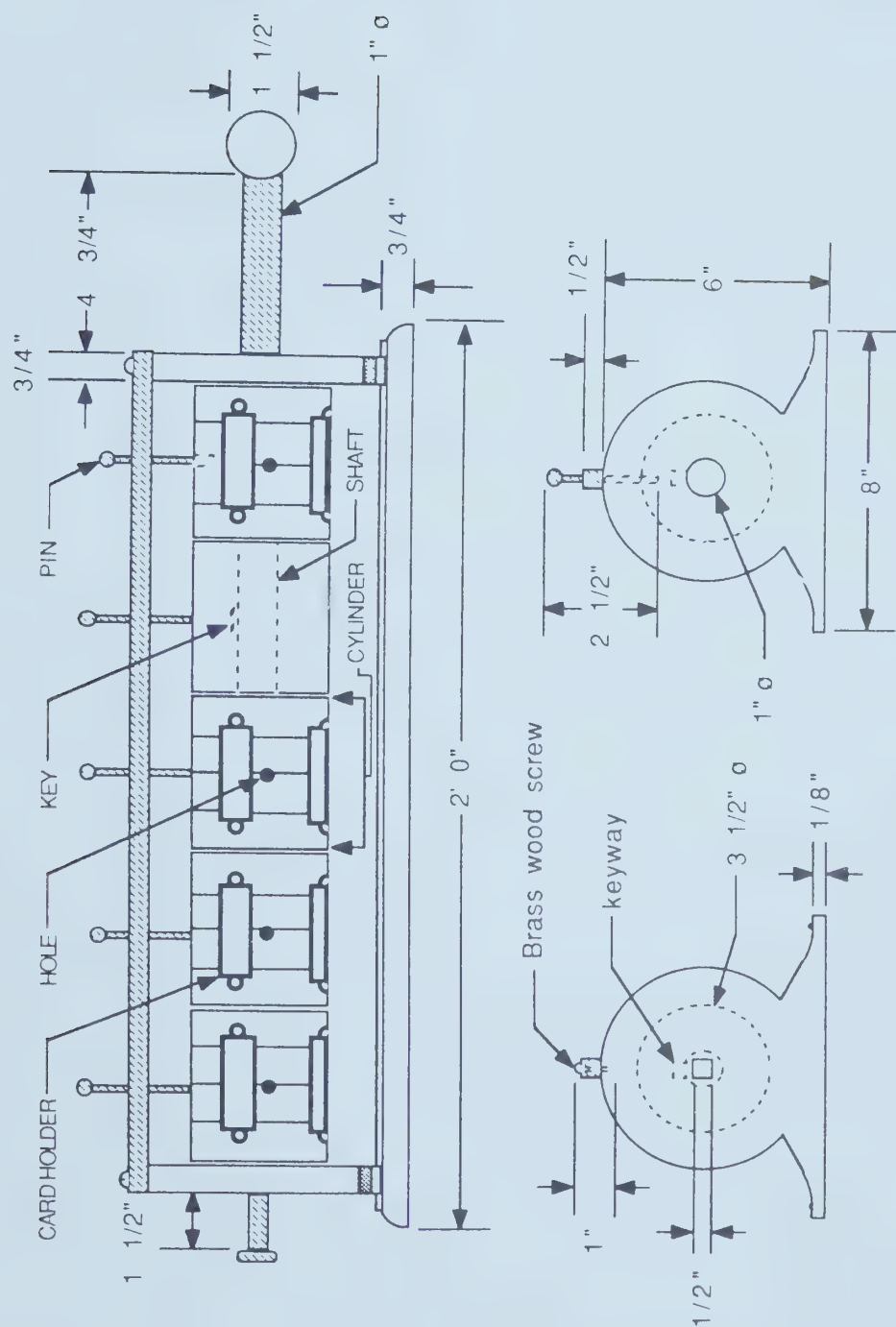
Figure 1: The hierarchical envelope test devised by LaZerte

The Problem Cylinder

There were distinct disadvantages to the Envelope Test. In order to prevent cheating, a supervisor had to be present while the test was in progress. The supervisor, as well, had to restore the cards and the envelopes after each test. Each Envelope Test, therefore, required the undivided attention of a supervisor who, if a different system were used, could have been supervising several examinations simultaneously. In addition, the relatively small number of decisions available to the examinee meant that one could possibly guess the correct sequence of envelopes as well as the correct card (LaZerte, 1933, p. 58). To alleviate these problems, LaZerte devised, and had constructed in 1930, a machine which he called the "problem cylinder" (Figure 2). Although others such as the psychologist Pressey were also developing testing machines at this time, there is no evidence in the literature or elsewhere to indicate that LaZerte's work was anything but an independent endeavor (personal communications with H. T. Coutts, 1987). There is no similarity in the concepts behind or the design of the machines or the learning theory implicit in its structure.

LaZerte's apparatus consisted of a wood and brass frame which housed five laminated wooden cylinders. The cylinders were constructed so that a keyway was present throughout their length. In addition, the center laminations were designed so that the cylinder could be rotated around a key if it was positioned in the center of the cylinder. Each cylinder possesses five brass card holders, evenly spaced about the circumference. The card holders are intended to hold segments of equations or portions of a problem-solving strategy. In between each card holder is a small hole into which one can insert a brass pin located in a bar running along the top of the frame. The pin is intended to hold the particular cylinder in the selected position. The cylinders are mounted horizontally onto a tubular brass shaft which also has five steel keys fastened to it in a linear fashion. The keys are arranged so that they are normally located within the center of each cylinder, thus permitting each cylinder to rotate freely and independently. A square brass rod, which passes through a squared hole in the frame, is attached to one end of the shaft. The squared rod prevents the shaft from rotating so that the keys on the shaft will always be positioned along the top of the shaft. If all the cylinders are rotated on the shaft so that their keyways are aligned with the keys, the shaft can be slid one and a half inches to the right. This action signifies to the user that the problem presented has been solved correctly (LaZerte, 1933, p. 59, and author's observations). The operation of the problem cylinder is similar to cylindrical bicycle locks that are used at the present time. When the correct numbers are selected on the cylinders of the lock, the keyways of the cylinders are aligned, allowing the release of a keyed shaft within the lock, thus enabling the chain or wire locking the bicycle to be removed.

A total of 3,125 arrangements of the cylinders is possible, so that the probability of an individual guessing the correct position of all five cylinders is extremely unlikely. In operation, the subject was presented with a mathematical problem and was then instructed to solve it, starting with the left-



M. E. LaZerte's "PROBLEM CYLINDER"
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Figure 2

Unshaded areas = Maple wood
[shaded box] = Brass

most cylinder and proceeding to the right. Every cylinder held five cards, each of which displayed a part of a problem solving strategy. The subject was to select what was believed to be the correct strategy among the five cards on each cylinder. This was accomplished by the subject rotating each cylinder so that the desired information faced him or her. After each selection was made, the subject was supposed to insert a brass pin into a hole in the top of the cylinder to prevent it from being moved while the next selection was undertaken. When it was felt that all five cylinders were in the correct position, the subject was to pull on the shaft. If the shaft did not slide to the right, one or more cylinders were improperly positioned, and this was an indication to the subject that a mistake in the steps of solving the problem had been made and that he or she should try again.

LaZerte (1933) found that the problem cylinder was intriguing to students and was highly motivational. He stated that, "all subjects were very much interested in the problem presented to them. After the experiment was completed many requested to continue their efforts. Motivation was strong throughout" (p. 60). In a fashion similar to that of the Envelope Test, the problem cylinder could be arranged so that fewer than five cylinders could be used. In such cases, those cylinders not in use would not have cards inserted in their card holders. In addition, the cylinders not in use would be pinned in the unlocked position.

Unlike the Envelope Test, however, the problem cylinder could be used without constant supervision because there was no easy way in which the subject could cheat or sabotage the machine. Besides being a testing device, the problem cylinder could be used to demonstrate logic or the logical analysis of a problem. The question noted at the outset of this article comes to mind: Why was no attempt made to have the problem cylinder mass-produced and used in the schools in order to improve pedagogy and student learning? The answer is provided by LaZerte's findings. Although high motivation and interest were attributed to the problem cylinder in a kind of "halo" effect, LaZerte (1933) also discovered that the skill required to understand and to manipulate the apparatus added to the difficulty of the problem being solved: "It is apparent that the task of solving the problems on the cylinder is much more difficult than when presented in the usual form" (p. 65). Data gathered from comparison groups verified his findings (LaZerte, 1933, pp. 63-67). It seems probable, therefore, that if LaZerte's problem cylinder were to be used successfully as a "teaching machine," instructions and practice exercises would have to be provided so that the manipulation of the machine would not add to the difficulty of the problem presented. Thus much time and effort would have to be expended on training in the use of the machine. *Mutatis mutandis*, the same criticism may be applied to microcomputers used for instruction. In addition to being familiar with the physical hardware such as the keyboard and peripheral devices such as a mouse, the computer user must also know the peculiarities of the programs used. It is unlikely, therefore, that the user will be able to give full and undivided attention to the primary task until some time is spent in learning about the machine and the program being used. This phenomenon

has been experienced by most microcomputer users, including some who describe the frustration caused by the problem (Vargas, 1986). Given this drawback, LaZerte concluded that the use of a teacher was more efficient and more effective than the use of his problem cylinder.

While the problem cylinder might appear to be primitive by current technological standards, it must be kept in mind that in 1930 the areas of instructional devices and electronics were both extremely limited in their development. In addition, most small school boards then in existence possessed limited funds and no electricity; it therefore seems unlikely that technologically complex and expensive apparatus would or could have been purchased by these school boards. Had his experimental studies shown the problem cylinder to be a successful teaching device, or if LaZerte, like Skinner 25 years later, had decided to market the device despite indications that it would not be successful in the education market, the problem cylinder could probably have been manufactured inexpensively because of the small number of parts. If the brass parts were replaced by steel or aluminum, and the wooden parts replaced with Bakelite, the cost could have been reduced even further.

Later Innovations

Activity Oriented Mathematics

Between the mid-1930s and the mid-1940s, LaZerte's time was primarily consumed by administrative obligations, but his interest in developing testing and instructional devices did not disappear. By the end of World War II, LaZerte had been testing new "activity" mathematics programs in the University of Alberta's demonstration school (LaZerte, 1945, p. 12). The programs, intended for primary grades, entailed considerable laboratory time for each pupil. LaZerte (1945) noted that, "the pupils spent 60% of the time devoted to arithmetic in the laboratory" (p. 12). In addition, the program was intended to be primarily individualized instruction where the students learned largely on their own and the teacher supervised. In this case, "individualized instruction" did not refer to the following of a rote program individually. It was expected that each student would perform the experiments outlined and discover for himself or herself the concept or concepts involved (LaZerte, 1951, p. 1). The laboratory work consisted of the use of instructional aids that were intended to facilitate the concrete representation of concepts, as well as to facilitate problem solving. The apparatus included bead frames, various number boards and charts, special colored disks, cut-outs, and rudimentary measuring devices (LaZerte, 1945, p. 12). While it produced favorable results, LaZerte noted that this "activity program" was similar to the methods he had used prior to 1930, "before the progressive movement reached Alberta" (LaZerte, 1945, p. 12). This work culminated in the production of the combination text and activity manual entitled *Numbers Tell Their Story*, first published in 1953.

Although the problem cylinder had been considered unsatisfactory for individualized instruction, LaZerte continued to believe that instructional apparatus could be useful in certain situations. LaZerte (1953) stated that,

“the emphasis on the use of apparatus and equipment should prove of inestimable value to the teacher in the rural and ungraded school” (p. ii). In many such schools, the teacher was responsible for several grades simultaneously, so the time that the teacher could spend with each grade was extremely limited. Although Alberta had embarked on a program of eliminating one-room rural schools through centralization during World War II, the process took many years to complete. LaZerte’s observations continued to be valid for several years (Alberta Department of Education, *Annual Reports*, 1939-1965). The use of the *Numbers Tell Their Story* program appears to be ideally suited for such environments. LaZerte (1953) noted that “if he [the student] is to profit from the course, each pupil must do all the work himself. The teacher must not teach demonstration lessons. It is assumed that all pupils will have some equipment in their hands while the class is at work” (p. ii).

It should be recalled that LaZerte’s desire for such an individualized program may be observed as early as 1922 (LaZerte, 1922, p. 30). At that time, there were some prominent psychologists who believed that practical and concrete methods should be used in the instruction of concepts. Thorndike (1923) proposed three criteria for a successful program:

- (1) Provide enough actual experiences before asking the pupil to understand and use an abstract or general idea. (2) Develop such ideas gradually, not attempting to give complete and perfect ideas all at once. (3) Develop such ideas so far as possible from experiences which will be valuable to the pupil in and of themselves. (p. 179)

LaZerte’s (1953) *Numbers Tell Their Story* program appears to have met all three of Thorndike’s criteria. To be sure, much of the material mentioned above, such as bead frames and felt cut-outs, were already available from school suppliers. Indeed, some of the items are still available (Primary School Supplies, 1987). Some of the apparatus was designed by LaZerte, however, and was not already available. Such equipment included perception cards (domino-like flash cards); number board (a wooden tray which could hold colored blocks in order to actualize addition and subtraction); place value frame (a shallow cardboard or wooden box marked in thirds, with nine slots in each third designed to hold colored disks); and the hundred board (a 23-inch square board, marked in quadrants with 25 hooks or nails arranged in rows in each quadrant, to illustrate submultiples of 100) (LaZerte, 1953; LaZerte, Dey, & Svidal, 1959). Originally, if one desired, complete sets of equipment could be ordered from the publisher (LaZerte, 1953, p. iv). In addition, concise instructions were provided on how to fabricate all the equipment mentioned in the book. As LaZerte (1953) noted, “if a school feels that it cannot undertake the expense of one set per child, the laboratory equipment is of such a simple nature that much of it can be reproduced in the school itself, at little cost” (p. iv). LaZerte’s economical laboratory program was unlikely to be rejected because of its costly equipment, a consideration that did not seem to occur to Skinner and others who promoted expensive teaching machines and equally expensive instructional courseware.

Although prepared laboratory equipment packages were not offered from the publisher in later editions of *Numbers Tell Their Story*, the book remained in print until the mid-1960s (royalty statements in the LaZerte Papers, University of Alberta Archives). From this evidence, it appears that LaZerte's innovation of laboratory mathematics was reasonably successful, although it was eventually eclipsed by devices and curricula developed by individuals who took advantage of the mass-market distribution of publishers and manufacturers. By such means, many inappropriate and inferior devices and programs were, and still are, being foisted on educators as well as the general public.

Implications

In 1959, several years after his retirement, LaZerte wrote an article in which he foresaw little positive change in education and the repetition of previous mistakes because of a lack of innovation by educators. LaZerte (1959) believed that "too many of our colleagues are timid—afraid of change—afraid to use their professional freedom" (p. 49). LaZerte's observation is a likely explanation why various specialists in other disciplines have sought to improve education; it appears to them that little is being done within the discipline to improve it (Skinner, 1984). In addition, when it appears that the accomplishments of previous educators are being ignored or forgotten, others may fear that no progress has taken place.

The development and marketing of devices to enhance learning has continued during the last 50 years, with much impetus coming from the United States. While some of these devices have been useful in Canadian schools, others have been inappropriate because of their cost or incompatibility with the curriculum or school system (Rutherford, 1961). A review of the work of M.E. LaZerte indicates that as early as 1922, devices and materials to support learning were being developed and researched in Canada. Although some of LaZerte's research indicated that certain devices did not enhance learning in the most efficient manner, some of his devices and methods did, such as his *Numbers Tell Their Story* program, which was designed with Canadian schools in mind, particularly rural schools. LaZerte's work indicates that Canadian educators are sufficiently competent and innovative to engage in such research and development; they do not necessarily have to follow a lead or trend originating in the United States. Furthermore, LaZerte's experiments and findings suggest that there is a need for educators to evaluate critically the effectiveness of such devices and materials in the context of the local classroom before they are widely accepted for use in the field of education.

Acknowledgments

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George Murray Dunlop

This special issue concludes with research abstracts from the current recipients of the G.M. Dunlop awards for outstanding theses at the master's and doctoral levels.

George Murray (Pat to those who knew him) Dunlop was born early in this century in Ontario. By the time he reached high school age, his family had moved to Saskatoon, where he finished school and earned a BA from the University of Saskatchewan. Seeking his fortunes further west, Dunlop taught high school history in Medicine Hat and Calgary with considerable success. In 1927, Pat Dunlop was appointed Inspector of Schools for the Foremost district in southern Alberta. Further promotion was rapid, as he was appointed to the staff of the Edmonton Normal School in 1928 to teach psychology and history.

While at the Edmonton and Camrose Normal Schools, Dunlop completed his MA in history and began to conclude that personal upgrading of qualifications was insufficient for the discipline as a whole; there had to be ongoing academic research. This idea occurred to others as well. Obtaining a leave from the staff of the Edmonton Normal School in 1941, Major Dunlop returned in 1945 to find that the normal schools were no more, and that education was considered a legitimate discipline, now a Faculty of Education at the University of Alberta (Edmonton and Calgary campuses). Dunlop soon earned a doctorate from Teachers College, Columbia University, and began to push for the formation of a scholarly outlet for educational research in Alberta. To this end he was instrumental in laying the groundwork for the establishment of the *Alberta Journal of Educational Research*. Preferring to advance the cause of educational research in the trenches, Dunlop did not desire to be editor of the *AJER*. Until shortly before his death on July 12, 1966, G.M. Dunlop remained active both in teaching and in the promotion and fostering of educational research at the University of Alberta.

The Dunlop awards, presented by the Canadian Association of Educational Psychologists of the Canadian Society for Studies in Education (CSSE), were created in memory of Dr. Dunlop.

Research Abstracts of the 1993, 1994 Dunlop Award Winners

Effects of Teaching Statistical Laws on Reasoning About Problems *Abstract: Doctoral Dissertation*

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Contemporary psychology, in the tradition of Thorndike and James, has largely been characterized by the belief that instructionally useful inferential rules are not abstract or general. In contrast, recent research supports a view that instruction in abstract rule systems can improve reasoning about ill-defined problems that abound in real life. More specifically, the research shows that instruction in statistics can influence the way people reason about events involving uncertainty in everyday life and can produce knowledge that readily transfers to types of problems outside those focused on in instruction.

Building on a study by Fong, Krantz, and Nisbett (1986), who found that training people to use the heuristic of the law of large numbers substantially enhanced their reasoning about everyday statistical problems, three experiments that investigated the effects of instructing students about this statistical heuristic were performed. The experiments were carried out with a total of 315 participants in university as well as secondary and elementary schools.

The results (a) indicate that students learned a good deal about how to reason statistically as a consequence of instruction; (b) reveal no problem format-specificity of instructional effects; and (c) suggest that typical reasoning errors were reduced by instruction in the statistical heuristic. These results stand in contrast to antiformalist views that stress domain-specificity in problem solving and lend support to the formalist view that teaching people to apply formal rules of inference can help them to reason more accurately about a variety of probabilistic events. In general, the findings bolster an optimistic view about the potential of rather limited instruction to foster valid reasoning about problems for students in university as well as in secondary and elementary schools.

Pete Kosonen is currently a school principal in Coquitlam, BC. His primary research interest is in the psychology of problem solving and transfer with a view to developing instructional programs to enhance reasoning about problems, based on finding out how people learn to think.

*The Effect of Problem Text on Solving Difference-Finding
Word Problems*

Abstract: Master's Thesis

*Ning Fan
University of Calgary*

This study investigated the effect of problem text on simple arithmetic word problem solving involving difference finding between two disjoint sets. Data on correct solutions and problem solving strategies for three types of such word problems, namely COMPARE, EQUALIZE, and WON'T GET, were collected from first-grade students and analyzed in a repeated-measures analysis of variance design. The correct solution scores of the EQUALIZE and WON'T GET problems were found to be significantly higher than those of the COMPARE problems. The strategy results further revealed the dependency of strategy use on the type of problem text, in that the EQUALIZE problems were most frequently solved by using an ADD-ON strategy, and the WON'T GET problems by a MATCH strategy, whereas there was no one strategy used significantly more than others for the COMPARE problems. The use of the ADD-ON and MATCH strategies reflected the construction of a coordination between two mental number lines while the problem representations were being built. These results suggested that the EQUALIZE and WON'T GET problem texts facilitated the coordination between the two number lines, but the problem text of COMPARE did not facilitate the coordination which was crucial for solving the difference finding problems. This study shows the value of incorporating a cognitive development framework with the domain-specific mathematical and linguistic models of word problem solving.

Ning Fan received his Bachelor of Education degree from Beijing Normal University in 1985, and Master of Science degree from University of Calgary in 1993. He is currently studying in a PhD program in University of Pittsburgh.

A Cognitive Developmental Analysis of the Interpretation of Family Stories by Adolescents and Preadolescents
Abstract: Master's Thesis

Diane J. Salter
University of Calgary

This exploratory study investigated cognitive developmental changes in the understanding of family stories by children and adolescents. A neo-Piagetian theoretical framework was used to assess the developmental progression in the meaning that subjects attributed to their family story.

Children and adolescents (aged 10, 12, 14, and 18 years) were asked to relate a "family story." The meaning that the story held for them was explored by interviewing each child about his or her understanding and interpretation of the story content. The results of the qualitative and statistical analysis demonstrated that children's understanding of the meaning of the story changed according to a developmental schedule. Responses were organized into four categories or levels of response. These levels were consistent with theory in cognitive development proposing developmental increases in structural complexity. A qualitative difference was noted between the responses given at age 10 and the responses given at age 12. No significant difference in response was noted between age 12 and age 14. A statistically significant difference occurred from age 14 to age 18.

A linear developmental progression was noted, with subjects at age 10 scoring significantly lower than all other groups and subjects at age 18 significantly higher. The younger child focused mainly on the action and interpreted the story as primarily a patterning of events motivated by feelings, desires, and beliefs, whereas the older child recognized that the story pattern contained a message that could be generalized to others. The older child, thereby, voiced his or her understanding of the world by interpreting the meaning of the story.

Diane Salter is currently completing her doctorate at the Ontario Institute for Studies in Education in the Department of Cognitive Psychology. Her primary research interest is adolescent understanding of intention in oral and written history.

*Effects of Conflict and Knowledge-building Approach
on Conceptual Change*

Abstract: Doctoral Dissertation

Carol K.K. Chan

Ontario Institute for Studies in Education

This study examined knowledge construction and conceptual change in the context of how high-school students process contradictory information in the domain of biological evolution. Investigations using a conflict-based approach to foster conceptual change have yielded equivocal findings. Based on the conceptual framework of constructive activity in learning, this study aimed to investigate whether the contrasting approaches of direct assimilation and knowledge building differentially affected conceptual change, and whether the effects of conflict were mediated by knowledge-processing activity. A related objective was to examine whether peer interaction fostered conceptual change when students were presented with new concepts which contradicted their joint understanding.

In order to assess individual differences in processing contradictory information, a computer-based connectionist methodology was developed that would allow the experimenter to select new information contingent upon students' expressed beliefs. The sample consisted of 108 students in grades 9 and 12 randomly assigned to four conditions: individual assimilation, individual conflict, peer assimilation, and peer conflict. Depending on the conditions, students were asked to think aloud or discuss with their peers eight scientifically valid statements presented in the order which either maximized or minimized conflict. Verbalizations were tape-recorded for subsequent analyses of knowledge-processing activity. Several measures of posttest conceptual change were also obtained.

Protocols were coded for five different levels of knowledge-processing activity. Two major approaches were identified: direct assimilation which involves fitting new information with what is already known, versus knowledge building which involves treating new information as something that needs to be explained. A path analysis showed that only knowledge-processing activity exerted a direct effect and mediated the effects of conflict on conceptual change. Merely confronting students with contradictory information was not sufficient unless students actively carried out a knowledge-building approach to deal with cognitive conflict. No main effects for peer interactions were obtained; the interaction effects, however, indicated that older students in the conflict group benefitted more from peer learning. Knowledge-building as a mediator of conflict in conceptual change helps explicate previous equivocal findings and highlights the importance of students' constructive activity in advancing their knowledge.

Carol Chan completed her PhD at the Ontario Institute for Studies in Education under the supervision of Dr. Carl Bereiter. Her research interests include text processing, problem solving, and collaborative learning.

Children's Perceptions of the Learning Process
Abstract: Master's Thesis

Gillian Bickerton
University of British Columbia

Although there is extensive literature on the learning process, what is apparent is the relative absence of any in-depth inquiry into what learning itself means to children and where they believe learning "comes from." The objective of the study was to determine if there is a developmental sequence in children's understanding of learning, such that children of the same age think in a similar fashion about learning and there is increasing complexity in understanding with age. A neo-Piagetian model of intellectual development (Case, 1985, 1992) was used as a theoretical framework. Children aged 6 to 12 years were interviewed about their understanding of the meaning of learning.

The study indicated significant age-related differences in level of understanding of the meaning of learning; they were hierarchical in nature supporting the theoretical predictions of a developmental sequence postulated by Case (1985, 1992). children progressed from a simple conception of learning defined in terms of intentionality, in other words, learning as a behavioral act combined with an internal feeling or judgment state, to more complex notions of intentional behavior as they relate to the process of learning. An interpretive understanding of the learning process characterized the 12-year-olds' responses; that is, responses were more psychological in nature with recognition of "states of mind" as important in learning.

The complexity of the "source" responses also increased with age. In the early stages there was a clear distinction between external sources (learning located in an action or "learning agent") and internal sources (learning located within the physical or psychological self). For older children there was an awareness of learning taking place in a sequential manner from external to internal. Interrelatedness of the two sources was generally recognized by 12 years of age.

By revealing common age-typical patterns of understanding of the learning process, this study suggests that educational methods and materials should be consistent with children's levels of conceptual development (compare Case & McKeough, 1990; Case, Sandieson, & Dennis, 1986).

If the goal in education today is to assist children in becoming independent learners, educators need to first of all understand children's conceptions of learning. This will result in more effective instructional design.

Gillian Bickerton is an experienced elementary school teacher having taught in London, Ceylon, Saskatchewan, and Langley, BC. She has been a faculty associate at Simon Fraser University and recently a learning assistance helping teacher in the Langley school district. She is currently working as a resource teacher in the same district while pursuing a doctorate at the University of British Columbia.

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